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Self-directed learning readiness of students in health professional preparation programs: Informing teaching and learning approaches

Craig Edward Slater
University of Wollongong

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Self-directed learning readiness of students in health professional preparation programs: Informing teaching and learning approaches

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This thesis is presented as part of the requirements for the conferral of the degree:

Doctor of Philosophy

The University of Wollongong
School of Health and Society

July 2018

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This research has been conducted with the support of an Australian Government Research Training Program Scholarship.

Declaration

I, Craig E. Slater, declare that this thesis submitted in partial fulfilment of the requirements for the conferral of the degree Doctor of Philosophy, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Craig E. Slater

20 July 2018

Abstract

Background

Self-directed, lifelong learning has widely been considered important for health professionals in maintaining knowledge and skill currency. Professional accreditation standards often require health professional programs to develop these attitudes and abilities in pre-certification students, assuming that SDLR is 'teachable' rather than an individual 'trait'. Programs have, therefore, sought to investigate students' self-directed learning readiness (SDLR) to determine: (i) when students are ready to engage in self-directed learning; (ii) the effect of curricular efforts; and (iii) the utility of SDLR in predicting academic outcomes of interest. As such, there is a need for comprehensive investigation of SDLR to determine the implications for teaching and learning.

Aim

The overarching aim of this research was to investigate SDLR of students in pre-certification health science programs to inform teaching and learning approaches.

Method

This research consists of five studies: two literature reviews and three observational studies. The observational studies were conducted with students in seven undergraduate health science disciplines at a large, metropolitan university in Sydney, Australia. The programs included were health services management, health promotion, therapeutic recreation, sports and exercise sciences, occupational therapy, physiotherapy and podiatry.

The first study is a scoping review exploring the range of factors investigated for association with SDLR of students in pre-certification health professional programs. This study followed a five-stage framework. The range of factors investigated were identified and significant findings presented. This study was published in the peer-reviewed journal, *Nurse Education Today*.

The second study developed a protocol for a systematic review investigating the psychometric properties of instruments measuring SDLR which have been used with pre-certification students

in health professional programs. The manuscript for this study has been submitted to the journal, *Systematic Reviews*, for peer-review.

The third study is a cross-sectional survey which investigated the influence of a range of factors on student SDLR in first year, first semester. Associations and effect sizes are presented for each of the factors investigated. A model was developed explaining 52.9% of SDLR variance. This study was published in the peer-reviewed journal, *BMC Medical Education*.

The fourth study is a cohort study which investigated the influence of SDLR and other factors on academic performance. Associations and effect sizes are presented for each of the factors investigated. A model was developed explaining 25.9% of the variance. The manuscript for this study has been prepared for submission to the *Journal of Allied Health* for peer-review.

The final study is a longitudinal cohort study which investigated changes in student SDLR over time. SDLR was measured in first year and then again in third year. A decline in SDLR was found across cohort, which was associated with GPA and personality factors. The manuscript for this study has been prepared for submission to the *Journal of Allied Health* for peer-review.

Conclusion

This study series provides a comprehensive examination of SDLR of students in pre-certification health professional programs. For some disciplines, this thesis presents an investigation of SDLR attributes and associated factors for the first time. The study series also investigated personality for association with SDLR for the first time in the health disciplines. Findings demonstrated that program, previous education and personality factors were predictive of SDLR. SDLR was not predictive of academic performance, however, gender and program were. Across the cohort, SDLR decreased over the three years. This research informs educators of the nature of SDLR, that it is not a trait, and that it can be influenced over time; although further exploration of influential factors is necessary. It also provides important recommendations for future research relating to the academic and professional utility of SDLR.

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First and foremost, I would like to thank my primary supervisor, **Professor Anne Cusick**. I have been so fortunate to have had this opportunity to work with you. I have learned so much from you, both professionally and personally. I have always admired your diligence and fortitude while still being able to see the big picture and keep perspective of what is important. You are both brilliant and compassionate. Thank you for always meeting me where I'm at, always having faith in me, and always looking to encourage and extend me. Thank you for the countless hours you've spent providing valuable feedback and guidance. Thank you!

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Mum and Dad, I dedicate this thesis to you both.

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List of publications resulting from research

Slater, C.E. & Cusick, A. (2017). Factors related to self-directed learning readiness of students in health professional programs: A scoping review. *Nurse Education Today*, 52, 28-33. doi: 10.1016/j.nedt.2017.02.011

Slater, C.E., Cusick, A. & Louie, J.C.Y. (2017). Explaining variance in self-directed learning readiness of first year students in health professional programs. *BMC Medical Education*, 17, 207. doi: 10.1186/s12909-017-1043-8

Slater, C.E., Cusick, A. & Louie, J.C.Y. (2017). Psychometric properties of instruments measuring self-directed learning readiness: a systematic review. *PROSPERO: International prospective register of systematic reviews*. Available from http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017078828

List of presentations resulting from research

Slater, C.E., Cusick, A. & Louie, J.C.Y. (2013). 'Self-directed learning readiness of health science students'. Australian & New Zealand Association of Health Professional Educators (ANZAHPE) conference. Melbourne, VIC.

Acronyms and Abbreviations

<i>ANOVA</i>	Analysis of Variance
<i>'Big Five'</i>	'Big Five' Personality Factors / 'Big Five' Personality Trait Inventory
<i>BMC</i>	BioMed Central
<i>CINAHL</i>	Cumulative Index to Nursing and Allied Health Literature
<i>COSMIN</i>	Consensus-Based Standards for the Selection of Health Status Measurement Instruments
<i>ERIC</i>	Educational Resources Information Center
<i>GPA</i>	Grade Point Average
<i>HREC</i>	Human Research Ethics Committee
<i>I-E-O Model</i>	Input-Environment-Outcome Model
<i>IPIP</i>	International Personality Items Pool
<i>ISLHD</i>	Illawarra Shoalhaven Local Health District
<i>MEDLINE</i>	Medical Literature Analysis and Retrieval System Online
<i>OCLI</i>	Oddi's Continuing Learning Inventory
<i>PBL</i>	Problem-based learning
<i>PRISMA</i>	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
<i>PsychINFO</i>	Psychological Abstracts
<i>SDL</i>	Self-Directed Learning
<i>SDLI</i>	Self-Directed Learning Inventory
<i>SDLR</i>	Self-Directed Learning Readiness
<i>SDLRS</i>	Self-Directed Learning Readiness Scale
<i>SDLRSNE</i>	Self-Directed Learning Readiness Scale for Nursing Education
<i>UK</i>	United Kingdom
<i>UoW</i>	University of Wollongong
<i>USA</i>	United States of America
<i>WSU</i>	Western Sydney University

Chapter 1: Introduction

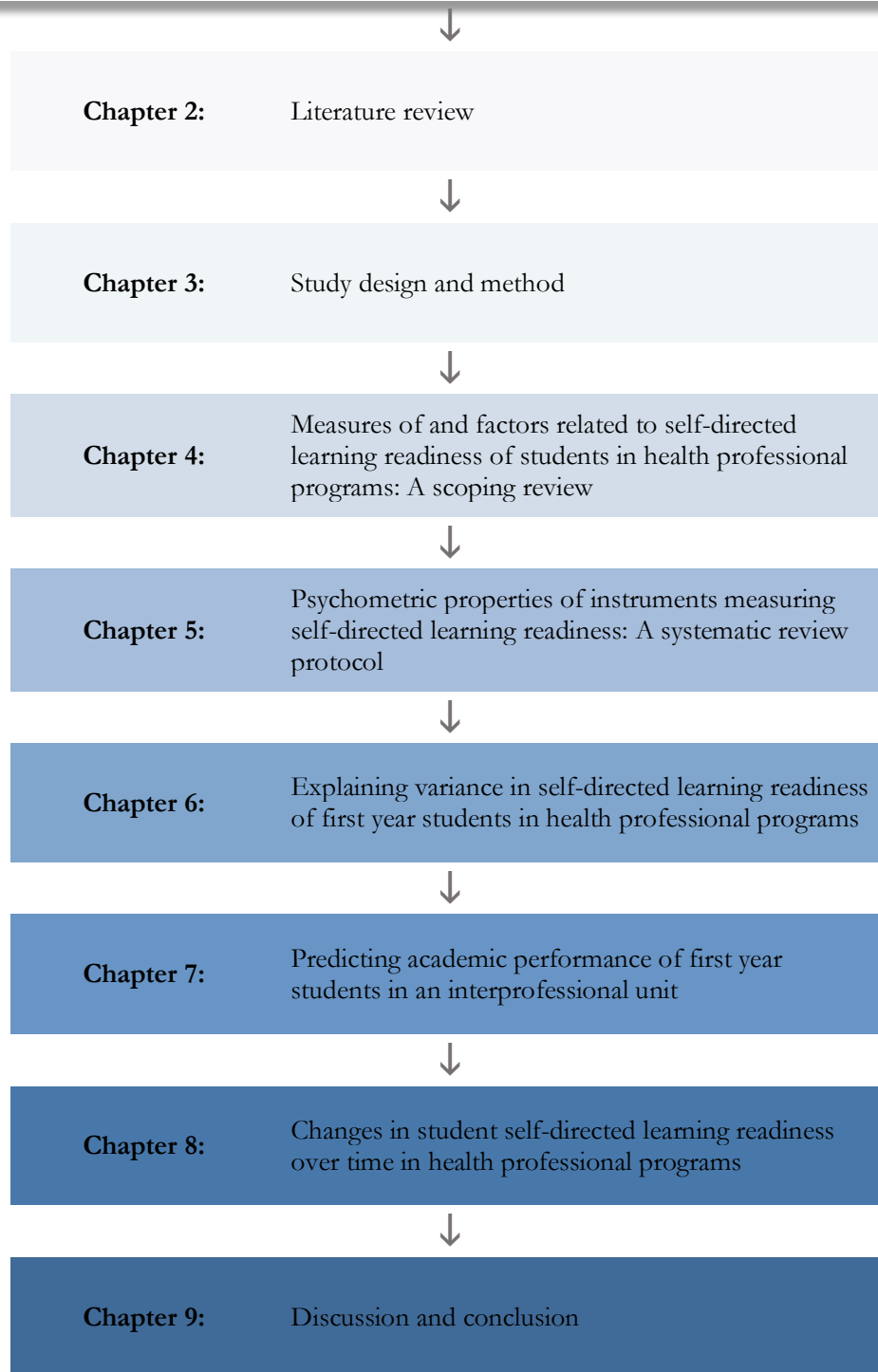


Figure 1.1 Thesis chapter progression: Chapter 1

Chapter 1

Introduction

1.1 Preamble

A learner's perspective of the questions explored in this study series.

Learning enables the extension, deepening and bettering of the self. Whether through formal education, informal learning activities, or through personal reflection, learning grants individuals access to that which was not known before. The opportunity to learn something, or become someone, is inherently exciting - the anticipation of future abilities; the hope of proficiency; and the promise of potential, both known and unknown.

This holds true for students learning to become professionals and practitioners in health-related fields. For these students, learning presents an added privilege of being able to assist and work collaboratively with persons, often vulnerable; and to have an impact on their experience of life, often for the better. Therein, 'learning to become' a health practitioner is the preparation for the responsibilities which lie ahead. These responsibilities demand continual updating of knowledge and skills. Continued lifelong learning is thus critical to practitioner competence. This learning ensures that the persons and populations served receive quality health care from highly skilled health professionals who use the most advanced disciplinary and interdisciplinary evidence and approaches available. Moreover, this learning ensures that these health professionals are responsive to the ever-changing health care environment and shifts in social and cultural values. This learning is required of the student and graduate practitioner in health and health related fields. Once a graduate, however, this learning must be self-directed as the structures and standards of a program are no longer there. Self-directed, lifelong learning has thus been of interest to educators in the health disciplines.

Undertaking this research, I drew on my own professional learning and practice experiences. First, as an undergraduate student in occupational therapy, a post-graduate student in public health and then as a doctoral student in a higher degree research program. Second, as an occupational therapy clinician who practiced in front-line patient service roles in hospital, clinic and community settings for over a decade. Third, as an educator in a state-level department of health setting and also in universities teaching in undergraduate and graduate level programs.

I reflected on my own approaches to studying, particularly my motivation and study skills, and how these influenced my professional practice as an occupational therapist. I reflected on my career as a clinician, and began to realise the extent to which I had developed in both clinical knowledge and skill over the years; and the factors – both intrinsic and extrinsic – which influenced this development. And lastly, I reflected on my current capacity as an educator, and the approaches I use to excite and enable students to develop their own knowledge and skills, not only throughout their program of study, but throughout their clinical careers. Through each of these lenses, it was apparent that self-directed learning (SDL) was critical to the process of developing new knowledge and skills. This was the impetus for this research.

In this PhD study series, I wanted to gain an in-depth understanding of SDL to inform curriculum development and my own teaching approaches. The recognition of SDL as an expectation and requirement for health professional practice, presented on the previous page; together with my personal experience as a learner and educator, led me to ask whether the students I was teaching were ‘ready’ for SDL. As I learned more about SDL, it became apparent that numerous theoreticians and health professional curriculum experts had recommended that SDL was so important for competent practice that it should be included in pre-certification curricula. I then wanted to know whether SDL attitudes and abilities could be ‘taught’. There seemed to be an assumption in the literature that it could be, with many studies examining interventions thought to affect SDL; but there was also a minor debate suggesting it was perhaps indicative of individual traits. I decided to focus on pre-certification programs because

these produce the health practitioner graduates assumed to be ready for SDL in their careers. I also wanted to know whether SDL, and students' readiness to engage in it, could be adequately measured. And, since pre-certification training occurs over a number of years, I wanted to know whether SDL changed over time. Finally, as I came to examine previous and current SDL research, I wanted to know whether capacity for SDL, as indicated by readiness, was associated with demographic or program factors – factors that may or may not be amenable to change through instruction. These questions shaped the development of the research program presented in this thesis. This chapter first explores the context of the study series, identifying factors that underpin the recent policy and research interest in SDL for health professionals.

1.2 Context of the study

Health care practices are constantly evolving in response to, and in anticipation of, scientific and theoretical advances, technological developments, and societal change. Health professionals need to maintain currency in knowledge and skill through lifelong learning to ensure their individual practice reflects changing community need and adapts to new systems (World Health Organization, 2010). An integral aspect of lifelong learning is the ability for individuals to engage in SDL activities (Cropley, 1980; Organisation for Economic Co-operation and Development, 1998).

In health professional practice, self-directed lifelong learning is largely understood in the context of continuing professional development (CPD) as a mechanism for maintaining knowledge and skill currency. Professional societies and/or governments have recognized the need for CPD by mandating a minimum number of CPD hours each year for individual practitioners to maintain registration and/or society membership. In light of this, pre-certification health professional programs are encouraged to use intentional educational approaches to develop students' skills and abilities in SDL to prepare them for professional practice (American Association of Colleges of Nursing and Association of American Medical Colleges, 2010). A concept of self-directed learning 'readiness' (SDLR) has thus been of interest as health professional programs as

a precursor for SDL. Wiley (1983) describes this concept of SDLR as the degree to which individuals possess the “attitudes, abilities and personality characteristics for self-directed learning” (p.182).

In Australia, the site of this PhD study series, the Australian Health Practitioner Regulation Agency (AHPRA) is the government authority charged with registration of nursing, medical and some, but not all, allied health professions (<https://www.ahpra.gov.au/>). Registration boards for each of the professions monitor, among other things, fulfillment of mandatory CPD requirements and annual registration is conditional upon those requirements being met. Among the allied health professions regulated by AHPRA are those included in this study series: occupational therapy, physiotherapy and podiatry. In health professions not regulated under AHPRA, both clinical and non-clinical, professionals can practice without registration, but may seek accreditation or recognition through membership with their professional society; these typically set CPD and practice requirements for membership. There are four such professions included in this study series: health promotion, health services management, sports and exercise sciences, and therapeutic recreation (also known in Australia as ‘diversional therapy’).

The CPD requirements for all professions included in this study series are presented in *Table 1.1*. It is noteworthy that ‘minimum hours’ are used by all as the measure. For most professions, the purpose of CPD is characterized generally as learning which maintains or extends competence in professional practice. As such, it is up to health professionals to diagnose their own learning needs, set their own learning goals, source learning resources, implement learning strategies and honestly report the ‘minimum hours’ of this activity. This is lifelong learning in action, and to do it properly, practitioners need to have a readiness for this type of learning, and the skills and knowledge to be able to engage in SDL. As maintenance of knowledge currency is an integral aspect of professional practice, health professional preparations programs are tasked to equip students with skills that will enable them to engage in SDL and attitudes that will foster a commitment to lifelong learning.

Profession	CPD requirement
<i>Health professions regulated by AHPRA</i>	
Occupational Therapy	Minimum 30 hours of CPD each year to maintain professional registration with AHPRA. (Occupational Therapy Board of Australia, 2012)
Physiotherapy	Minimum of 20 hours of CPD each year to maintain professional registration with AHPRA. (Physiotherapy Board of Australia, 2015)
Podiatry	Minimum of 20 hours of CPD each year to maintain professional registration AHPRA. (Podiatry Board of Australia, 2015)
<i>Health professions not regulated by AHPRA</i>	
Health Promotion	Minimum 120 hours of CPD over a three-year period to maintain registration with the International Union for Health Promotion and Education (IUHPE). (Not mandatory for practice in Australia.) (Australian Health Promotion Association, 2017a)
Health Services Management	No specific requirements for membership with the Australasian College of Health Service Management.
Sport and Exercise Sciences	Minimum 20 hours of CPD each year to maintain accreditation as an exercise scientist with the professional association. (Exercise & Sports Science Australia, 2017b)
Therapeutic Recreation	Minimum of 15 CPD points each year to maintain full membership with the professional association. (Diversional Therapy Australia, 2014)

Table 1.1 CPD requirements for professional registration or professional society membership for those disciplines included in the PhD study series.

In Australia, SDL has been a feature of health professional preparation curriculum for over two decades (e.g. Candy, 1995; McMillan & Dwyer, 1989; Newble & Hejka, 1991; Titchen, 1992). Most published Australian SDL curriculum description and evaluation has been in medicine and nursing with less evidence available in allied health disciplines. Some Australian allied health and health practitioner disciplines are yet to have student SDLR research conducted (e.g. podiatry, sports and exercise science, health service management, health promotion and therapeutic recreation); indeed these professions have not yet had SDLR research published internationally.

Research into SDLR has used both quantitative and qualitative methodologies; the latter characterized by a focus on describing or evaluating the impact of educational interventions on SDLR (e.g. Falk, Falk, & Jakobsson Ung, 2016; Green & Schlairer, 2017; Lunyk-Child et al., 2001). The current study series focuses the SDLR of students in five pre-certification undergraduate health science programs covering seven disciplines. Four of the disciplines had profession-specific named programs with compulsory standardized curricula: occupational therapy, physiotherapy, podiatry, and sports and exercise science. Three of the disciplines were majors within a health sciences undergraduate program: therapeutic recreation, health promotion or health services management. Occupational therapy, physiotherapy, podiatry programs produced registered practitioners; while the sports and exercise science, and health sciences programs produced practitioners eligible for society membership.

In Australia, individuals can apply for registration as a practitioner through a number of routes, but the most common is that the graduate has completed a training program deemed 'eligible' by the relevant registration board or professional society – usually this is because it has been accredited by the professional society or an independent body set up for that specific purpose. For example, occupational therapy programs accredited by the Occupational Therapy Council (2016) are recognized by the Occupational Therapy Board of Australia, under AHPRA. For those practitioners who are not registered, a similar process is used. For example, graduates of sports and exercise science programs accredited by Exercise and Sports Science Australia (ESSA) (2013) are eligible to become ESSA Accredited Exercise Scientists.

Through the program accreditation process, health professional programs need to demonstrate how the training prepares students to meet the competency standards for entry-level professionals in the respective discipline. Many of these standards relate to self-directed, lifelong learning or self-initiated engagement in CPD. Such references in competency standards of the health professions investigated in the current study are presented in *Table 1.2*. Health professional programs will, therefore, often use intentional educational approaches to prepare students to meet these competency standards.

Many pre-certification health professional programs have employed strategies to ‘teach’, ‘develop’, or ‘build’ SDL skills. These include problem-based learning, online learning, team-based learning, flipped classrooms, and targeted SDL activities – these strategies are reviewed in more detail in *Chapter 2*. These learning strategies either necessitate or anticipate higher levels of student competence in SDL. As such, educators have often been interested in understanding the impact of these strategies on students’ SDLR.

Aside from program and professional drivers for SDL, higher education institutions have also identified that lifelong learning capacity is a feature of all university education. Thus, at an institutional level, many universities have adopted graduate attributes or learning outcomes that include competence in self-directed, lifelong learning for all disciplines. Western Sydney University, the site of the current study, is a typical example. The graduate attributes statement articulates that graduates will command “multiple skills and literacies to enable adaptable lifelong learning” (Western Sydney University, 2015, p. 1). Other references to SDL in the graduate attributes statement include graduates being ‘self-reliant learner(s)’ and effectively ‘advancing knowledge both *independently* and collaboratively’. The university thus aims, through its educational programs, to foster an attitude of readiness for lifelong learning, and preparedness for SDL in all graduates. In Australia, the preparation for lifelong learning through university level education is a sector-wide feature mandated through government policy in the Australian Qualifications Framework (Australian Qualifications Framework Council, 2013).

Profession	Competency standards used for program accreditation <i>Numbers indicate the clauses within standards</i>
Occupational Therapy	<p>1.6 Maintains and enhances competence through lifelong learning and continuing professional development activities.</p> <p>6.1 Engages in lifelong learning processes and activities to maintain professional competence. (Occupational Therapy Council, 2013)</p>
Physiotherapy	<p>4.1 Assess their practice against relevant professional benchmarks and take action to continually improve their practice.</p> <p>4.2 Evaluate their learning needs, engage in relevant continuing professional development and recognise when to seek professional support, including peer review.</p> <p>(Physiotherapy Boards of Australia and New Zealand, 2015)</p>
Podiatry	<p>1.2. Utilises effective strategies for continually improving knowledge and skills.</p> <p>2.4 Engages in reflective practice, planning and action for ongoing learning.</p> <p>(Australian & New Zealand Podiatry Accreditation Council, 2015)</p>
Health Promotion	No program accreditation process.
Health Services Management	<p>5.2.1. Demonstrates commitment to self-development including continuing education, networking, reflection and personal improvement.</p> <p>(Australasian College of Health Service Management, 2016b)</p>
Sport and Exercise Sciences	<p>7. Commitment to self-development in the field of exercise science through educational engagement and ongoing learning, self-evaluation of practice, inter-professional working relationships and the support of new graduates, and advocacy for exercise science.</p> <p>(Exercise & Sports Science Australia, 2013)</p>
Therapeutic Recreation	<p>11.1 The maintenance of professional competence and continuing education.</p> <p>(Diversional Therapy Australia, 2017a)</p>

Table 1.2 Statements regarding lifelong learning in competency standards of the health professions included in this study.

Readiness for SDL, both in attitude and ability, is thus important for health professionals in meeting the CPD requirements set by professional bodies for the maintenance of professional registration or society membership. Health professional programs are responsible for developing students' knowledge, attitudes and skills to meet entry-level competencies, which often relate to self-directed, lifelong learning. As such, health professional programs have long had an interest in student SDLR, and educational methods which can prepare students for self-directed, lifelong learning. Program accreditation requirements, together with institutional objectives to develop graduates who are lifelong learners, have impelled health professional programs to adopt a range of educational methods targeting student SDLR.

While student SDLR is of interest in many health disciplines, most of the literature has been in the context of medical or nursing student cohorts (Slater & Cusick, 2017), as presented in *Chapter 4* of this thesis. Nursing spearheaded investigation of student SDLR in the 1980s (Linares, 1989; O'Kell, 1988; Wiley, 1983) and was the only discipline to publish on the topic until Linares (1999). While the earliest study of student SDLR in medical cohorts was Shokar, Shokar, Romero, and Bulik (2002), there have since been another 16 studies in the discipline (Slater & Cusick, 2017). The few studies which have been conducted in other health disciplines are discussed in detail in *Chapter 4* of this thesis. As such, it is important that the evidence in nursing and medical contexts informs the investigation of student SDLR in other health disciplines; particularly in those disciplines where there has been no investigation of SDLR.

Seven health disciplines were included in the current PhD study series: occupational therapy, physiotherapy, podiatry, health promotion, health services management, sports and exercise sciences, and therapeutic recreation. There has been limited exploration of student SDLR in these disciplines, as discussed in detail in *Chapter 4* of this thesis. As such, the breadth of evidence in medical and nursing student contexts informed the design and implementation of the five studies in this thesis, as follows:

1. *Scoping Review (Chapter 4)*

Nursing has been the only to conduct a structured literature review on the topic of SDL with particular attention given to concept of SDLR (O'Shea, 2003). A systematic review on the effectiveness of SDL health professional curricula (Murad, Coto-Yglesias, Varkey, Prokop, & Murad, 2010), however, it did not include studies which measured SDLR and the results included studies mostly in medicine. Given that no other structured or systematic literatures reviews were conducted in other disciplines, the methods described in these papers informed the search terms and search strategy used in study presented in *Chapter 4* of this thesis.

2. *Systematic Review Protocol (Chapter 5)*

In the nursing literature, Fisher, King, and Tague (2001) had disagreement about instruments traditionally used to measure SDLR, and consequently developed a new instrument for use in nursing student contexts named the Self-Directed Learning Scale for Nursing Education (SDLSNE). The SDLSNE was developed for use with nursing students, using Delphi technique with nurse educators. The instrument has since been used in health disciplines other than nursing such as medicine (Abraham et al., 2011; Gyawali, Jauhari, Ravi Shankar, Saha, & Ahmad, 2011; Monroe, 2016; Soliman & Al-Shaikh, 2015) and pharmacy (Huynh et al., 2009). To date there is no known systematic review of instruments measuring SDLS across the health disciplines. The systematic review described in *Chapter 5* of this thesis, explores the psychometric properties of instruments measuring SDLR, including the validity of each measure in different health disciplines.

3. *Observational Studies (Chapters 6, 7 and 8)*

As presented in *Chapter 4* of this thesis, investigation of student SDLR in the health disciplines has largely included medicine and/or nursing student contexts. The factors investigated in these studies influenced the selection of factors for the three

observational studies in the current PhD study series. The factors in the PhD study series included: age, gender, previous education level and year level which were found to be among the most commonly investigated and had the most indicative evidence of association with SDLR determined by statistically significant findings.

In the health disciplines, investigation of student SDLR has mostly occurred with students in pre-certification health professional programs. Pre-certification health professional programs are training programs which prepare students for practice in a particular health discipline. Students in these programs are not yet qualified to practice independently in the discipline. A more detailed description of pre-certification health professional programs is presented in below in section 1.7.13 of this thesis.

By comparison, *post*-certification health professional programs are post-graduate programs for health professionals who are already qualified for independent practice in a health discipline, and who which to either advance their knowledge and skill or specialize in an area of practice. As aforementioned, study of student SDLR in *pre*-certification health professional programs has largely been driven by program accreditation standards, which require academic programs to develop students' attitudes and abilities for self-directed, lifelong learning prior to entry into professional practice in the discipline. Investigation of students in *post*-certification health professional programs, however, has rarely been the subject of research enquiry given that students in these programs are already qualified, and mostly practicing in their respective discipline; and therefore, should already possess the necessary attitudes and abilities for self-directed, lifelong learning.

The focus on students in pre-certification programs in the current PhD study series will inform whether academic programs can influence student SDLR over the duration of the program, and to what extent curricular approaches prepare students with the attitudes and abilities for self-directed, lifelong learning required on entry into professional practice.

1.3 Statement of the problem

While SDL has attracted the attention of researchers and educators in the health disciplines, most research evidence relates to medical and nursing professions. Despite having similar professional practice requirements for CPD and competencies relating to lifelong learning attitudes, there has been much less inquiry into SDL in other health disciplines, particularly fields known in Australia as health science. As such, there is a need for further research in these professions to inform curricular approaches for developing self-directed, lifelong learners.

In investigating SDLR of students in pre-certification health science programs, it is necessary to gain an understanding of:

- i) previous research investigating factors which may influence student SDLR, both on entry and over time;
- ii) instruments used to measure SDLR; and
- iii) the relationship between SDLR and other academic outcomes.

1.4 Aim and objectives

The overarching aim of this research was to explore the SDLR of students in pre-certification health science programs to inform teaching and learning approaches. To do this, the study addressed a number of objectives through specific research questions. These are presented in *Table 1.3*.

The four objectives listed below were derived following a detailed review of the literature in *Chapter 2* (Section 2.6), which identified several gaps in the existing body of knowledge. These objectives were important and deserving of in-depth investigation, as described in *Chapter 2*, (Section 2.6) and *Chapter 3* (Table 3.1).

Objective	Research questions
1) To determine the factors which influence SDLR of students in health professional programs.	<ul style="list-style-type: none"> • Which factors have been investigated for potential association with SDLR? • Which factors have a significant relationship with SDLR of students in health professional program?
2) To develop a protocol to explore the attributes of instruments used to measure SDLR in health professional programs.	<ul style="list-style-type: none"> • Which instruments have been used to measure student SDLR in health professional programs? • What are the characteristics of instruments used to measure SDLR of students in health professional programs? • What are the psychometric properties of instruments used to measure SDLR of students in health professional programs?
3) To determine changes in students' SDLR between first year, first semester and third year, second semester.	<ul style="list-style-type: none"> • How ready are students for SDLR on entry into health professional programs? • Does student SDLR change over time? • Which factors influence SDLR change over time?
4) To determine the influence of student SDLR on academic performance.	<ul style="list-style-type: none"> • Does student SDLR influence academic performance?

Table 1.3 Objectives and research questions of the PhD study series

1.5 Scope and Significance

This thesis first explores what is known in the literature about self-directed, lifelong learning in the health professions; theoretical understandings of SDL; and curricular approaches used in the health disciplines to develop student SDLR. In reviewing the literature, several gaps in the body of knowledge were identified. While there has been interest in SDLR in the health disciplines,

there is limited evidence in disciplines other than medicine and nursing, especially in terms of factors which influence SDLR and the influence of SDLR on academic outcomes. Of particular interest, there has been an emerging discussion regarding the relationship between SDL and personality traits, however, there have been no studies investigating this in the health disciplines. Further exploration of the instruments used to investigate SDLR in the health disciplines is also required to guide researchers, particularly in disciplines other than medicine and nursing. To address these gaps in the literature, this PhD study series conducted five studies each of which make original contributions to the body of knowledge on SDLR.

The first study, *Factors related to SDLR of students in health professional programs: A scoping review*, was a review of the factors investigated in the literature for potential association with student SDLR in the health disciplines. Surprisingly, such a review had not yet been done. The study reports the range of factors, the frequency with which each factor was investigated, the relevant significant results presented in the literature, instruments used to measure SDLR, and the disciplines in which factors were investigated. This review synthesised the findings in the literature and informed a strategic approach to further exploration of SDLR.

The second study, *Psychometric properties of instruments measuring SDLR: A systematic review protocol*, developed a rationale and systematic review protocol to investigate the instruments measuring SDLR used in the health disciplines. In keeping with the best practice 'Preferred Reporting Items for Systematic review and Meta-Analysis Protocols' (PRISMA-P) 2015 statement (Moher et al., 2015), this study has been registered with PROSPERO, and the protocol paper has been developed prior to implementation and submitted for publication. This will be the first systematic review of SDLR instrumentation in the literature, and will provide evidence regarding the rigor and relevance of SDLR measures in cohorts of students in pre-certification health professional programs.

The next study, *Explaining variance in SDLR of first year students in health professional programs*, was a cross-sectional study of first year, first semester students in five health professional programs. A range of factors were investigated for association with student SDLR, and a model was developed which was able to account for variance in SDLR. This is the first adequately powered study ever conducted in published SDLR health professional student research to develop such a model. It also presented findings across the disciplines involved, some of which had previously never had SDLR data reported.

The fourth study, *Predicting academic performance of first year students in an interprofessional subject*, was a cohort study of students in five health professional programs. SDLR and a range of other factors, were investigated for association with student grades in an interprofessional unit. A predictive model was developed which accounted for variance in end-of-semester unit results. Since the study sample was drawn from students in an interprofessional unit, the study was also able to provide meaningful comparisons between programs.

The last study, *Changes in student SDLR over time in health professional programs*, was a longitudinal study which investigated SDLR of students in five health professional programs. This study investigated the changes in student SDLR over time, and the influence of a range of factors on these changes. It presented indicative evidence to inform further research of SDLR over time. The study contributes to discussion in the literature regarding the extent to which SDLR is influenced by cognitive or social development, personality traits and curricular approaches.

This PhD study series is a significant original contribution to knowledge as it fills gaps in the evidence base relating to SDLR for students in health science programs. For some, it adds to an emerging evidence base. For others, it presents SDLR information where there was previously limited or no attention. The study series also contributes to the body of knowledge for (a) the professional preparation of the health workforce, (b) curricular approaches for the first-year

experience, and (c) understanding student attributes in the context of institutional graduate attribute aspirations.

1.6 Limitations

The study series was limited to one university in metropolitan Sydney, Australia. It was also limited to undergraduate programs and seven disciplines – all of which prepare graduates for immediate entry to the health care workforce. Three of these disciplines are registered allied health professions (occupational therapy, physiotherapy and podiatry) in Australia. The others have opportunities for graduate membership with professional societies (health promotion, sport and exercise sciences, and therapeutic recreation) and/or program accreditation (health services management). Given the limited studies of SDLR in the registered and accredited health professions, the findings from this study may provide insights and impetus for further research in allied health disciplines not included in the study. The findings, however, are not intended to be generalised across all health professions.

The current study series focuses on the SDLR of students in health science programs. While there are professional practice drivers for SDL, the scope of the study does not include qualified health professionals in professional practice. Future studies may consider a longitudinal analysis of the relationship between student SDLR, program educational approaches and professional engagement in self-directed, lifelong learning.

The study series utilizes literature and observation cohort survey methodologies. In doing so, it achieves the aim of characterizing SDLR and factors that are associated with it. Gaps in the literature and important questions left unanswered by previously underpowered research are addressed. The study does not attempt to design, implement or evaluate an educational intervention on the basis of study series findings; this is left for others to do.

1.7 Definition of terms

Several terms are frequently used throughout this thesis. Definitions of these key terms are presented below to assist the reader to: (a) ascribe the intended meaning of these terms; and (b) understand the context in which the terms operate.

1.7.1 Self-directed learning

Self-directed learning (SDL) is fundamental to adult learning theory. While SDL has long been of interest, it is Knowles' definition which dominates the literature. Knowles (1975, p. 18) states that SDL is "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes".

1.7.2 Self-directed learning readiness

There is an intrinsic component to undertaking SDL; that is, individuals initiate the process, as defined by Knowles (1975). In light of this, educators have been interested in knowing whether individuals are ready to initiate the process and are ready for SDL. Wiley (1983, p. 182) defines this self-directed learning readiness (SDLR) as the degree to which an individual possesses "the attitudes, abilities and personality characteristics for self-directed learning".

1.7.3 Lifelong learning

On a superficial level, lifelong learning encompasses learning which occurs 'from cradle to grave', however, there are many nuances of lifelong learning which have been actively discussed in the literature. Veloski and Hojat (2006, p. 133) define lifelong learning as "a concept involving a set of self-initiated activities (behavioral aspect) and information-seeking skills (capabilities) that are activated in individuals with a sustained motivation (predisposition) to learn and the ability to recognize their own learning needs (cognitive aspect)". In the health professions, lifelong learning is largely understood in the context of CPD.

1.7.4 Health professions

In Australian legislation (Health Practitioner Regulation National Law Act 2009), the term 'health profession' has been defined by listing the fourteen professions which are nationally regulated through AHPRA. These are: Aboriginal and Torres Strait Islander health practice, Chinese medicine, chiropractic, dentistry, medicine, medical radiation practice, nursing and midwifery, occupational therapy, optometry, osteopathy, pharmacy, physiotherapy, podiatry, and psychology. Few other definitions for 'health professions' are presented in the literature or in Australian public policy. The Australian and New Zealand Standard Classification of Occupations (ANZSCO) provides a holistic definition of the term 'health professionals':

Health professionals develop health care programs and policies, conduct tests and diagnose and treat physical and physiological disorders, and provide nursing care, advice and counselling to patients to maintain, promote and restore good health and safe and healthy working environments.

(Australian Bureau of Statistics, 2013, para. 1)

For the purposes of this thesis, the term 'health profession' constitutes a discipline in which graduates of health programs practice in services soles in the health sector, inclusive of both clinical and non-clinical professions. Clinical health professions include, but are not limited to, medicine, dentistry, nursing, midwifery, registered allied health professions and accredited health practitioners, such as speech pathologists, social workers, exercise physiologists, exercise scientists, and diversional (or recreation) therapists. Non-clinical health professions include, but are not limited to, health promotion, public health, health services management and health information management. At times in this thesis, the term 'discipline' is used synonymously with 'health profession'.

1.7.5 Allied health

Allied health professions are clinical professions distinct from medicine and nursing, and constitute approximately 20% of the overall health workforce in Australia (Allied Health Professions Australia, 2017). To date, there is no national or international agreement as to which professions are considered 'allied health'. While allied health professions are diverse in their

respective scopes of practice, collectively these professions apply professional skill and knowledge to restore and maintain optimal physical, sensory, psychological, cognitive and social function (Lowe, Adams, & O'Kane, 2007). In the absence of a uniform agreement of 'allied health professions', this thesis will adopt the definition used by the Australian Health Workforce Advisory Committee (2006) which includes the following professions:

- audiology
- dietetics and nutrition
- occupational therapy
- orthotics and prosthetics
- orthoptics
- pharmacy
- physiotherapy
- podiatry
- psychology
- radiography
- social work
- speech pathology

1.7.6 Occupational therapy

The World Federation of Occupational Therapists (2012) defines occupational therapy as “a client-centered health profession concerned with promoting health and well-being through occupation. The primary goal of occupational therapy is to enable people to participate in the activities of everyday life. Occupational therapists achieve this outcome by working with people and communities to enhance their ability to engage in the occupations they want to, need to, or are expected to do, or by modifying the occupation or the environment to better support their occupational engagement” (para. 1).

1.7.7 Physiotherapy

The Australian Physiotherapy Association (2017) states that physiotherapy is “a healthcare profession that assesses, diagnoses, treats, and works to prevent disease and disability through physical means. Physiotherapists are experts in movement and function who work in partnership with their patients, assisting them to overcome movement disorders, which may have been present from birth, acquired through accident or injury, or are the result of ageing or life-changing events” (para. 1). Physiotherapy is also known as ‘physical therapy’ in some countries, including the United States of America (USA).

1.7.8 Podiatry

Podiatry is an allied health profession “dedicated to the diagnosis, treatment, prevention, and management of medical conditions and injuries of the foot, ankle and lower limb” (Australasian Podiatry Council, 2017, para. 1).

1.7.9 Health promotion

The Ottawa Charter for Health Promotion (World Health Organization, 1986) states that:

Health promotion is the process of enabling people to increase control over, and to improve, their health.

To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment.

(World Health Organization, 2017, para. 3)

Health promotion practitioners engage in the “planning, development, implementation and evaluation of health promotion policies and projects using a variety of strategies, including health education, mass media, community development and community engagement processes, advocacy and lobbying strategies, social marketing, health policy, and structural and environmental strategies” (Australian Health Promotion Association, 2017b, para. 4).

1.7.10 Health service management

Health service management is a discipline pertaining to the management of systems and people who deliver health care. Health service managers work in a range of roles including strategy, operations and policy. These roles occur in a range of settings including community health centres, hospitals, aged care facilities, government and the military (Australasian College of Health Service Management, 2016a).

1.7.11 Sport and exercise science

Sport and exercise science is an umbrella term for a range of careers including, but are not limited to, exercise physiology, sports coaching, exercise rehabilitation and fitness consultancy (Exercise & Sports Science Australia, 2017a). Graduates of the pre-certification program in

sports and exercise science at Western Sydney University can work as Accredited Exercise Scientists (AES) on application to Exercise & Sport Science Australia (ESSA). AESs specialise in exercise prescription for health and fitness, wellbeing, performance and prevention of chronic conditions (Exercise & Sports Science Australia, 2017c).

1.7.12 Therapeutic recreation

The discipline of therapeutic recreation is commonly known as ‘recreation therapy’ or ‘diversional therapy’. Diversional Therapy Australia (2017b) states that “diversional therapy is a client centred practice and recognises that leisure and recreational experiences are the right of all individuals. Diversional therapy practitioners work with people of all ages and abilities to design and facilitate leisure and recreation programmes. Activities are designed to support, challenge and enhance the psychological, spiritual, social, emotional and physical wellbeing of individuals. The diversional therapist provides opportunities where individuals may choose to participate in leisure and recreation activities which promote self-esteem and personal fulfilment” (para. 1).

1.7.13 Pre-certification health professional programs

‘Pre-certification health professional programs’ refers to programs of study in higher education institutions which prepare students for practice in a health profession. Completion of the health professional program is typically an eligibility requirement for membership in a professional association, or for professional registration to practice. Depending on the professional requirements in each jurisdiction, pre-certification health professional programs may be at the undergraduate or graduate degree level. In Australia, these programs are largely undergraduate programs of between three to six years in duration. This differs to the USA where pre-certification health professional programs are largely at the graduate level. In this thesis, the term ‘pre-certification health professional programs’ is inclusive of all pre-certification programs at the undergraduate and graduate levels. It is important to note that students in *pre*-certification programs are not yet qualified to independently practice in their discipline. This is distinct from students in *post*-certification health professional programs who are qualified to practice in their

discipline, but are undertaking post-graduate education to advance their knowledge and skill, or specialize in an area of practice. This PhD study series focusses only on students in *pre*-certification health professional programs.

1.7.15 Interprofessional education

Interprofessional education occurs “when two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes” (World Health Organization, 2010, p. 13). At Western Sydney University, where the observational studies took place, interprofessional units of study involve coursework where students across a number of different health professional programs learn together in mixed classes.

1.7.16 Unit

In this thesis, the term ‘unit’ refers to an academic unit of study which is undertaken in an academic program. Units are typically a semester in duration and are comprised of a series of classes or coursework activities along with associated assessment. The term ‘unit’ is synonymous with the terms ‘course’ and ‘subject’ used in some higher education settings.

1.7.17 Academic performance

In this PhD study series, academic performance is defined as the outcome of students’ engagement with education as measured by academic retention of results in:

- i. an educational task or activity,
- ii. an assignment or examination,
- iii. a learning module,
- iv. a unit of study, or
- v. as a grade point average of results across a number of completed units.

1.8 Structure of the thesis

This thesis is presented as a ‘thesis by compilation’ whereby chapters may include published papers, manuscripts submitted for journal review, or chapters written in a format consistent with scholarly journal article style guidelines (University of Wollongong, 2017). ‘Thesis by compilation’ is a desirable thesis format as it encourages students to publish throughout their candidature. The benefit of this is that students obtain valuable peer review feedback as they progress through their candidature, and that new knowledge is being disseminated in a timely manner.

In this thesis:

- four chapters are presented as conventional thesis chapters (Chapters 1, 2, 3, and 9)
- two chapters are papers which have been published in the peer-reviewed journals: *Nurse Education Today* (Chapter 4), and *BMC Medical Education*. (Chapter 6).
- three chapters are ‘in-draft’ manuscripts ready for submission to the peer-reviewed journals: *Systematic Reviews* (Chapter 5), and *Journal of Allied Health* (Chapters 7 and 8).

A description of each chapter is presented in *Table 1.4*. Chapters 1, 2 and 3 conclude with a chapter synopsis summarizing the information presented. Chapters 4, 5, 6, 7 and 8 begin with a preamble orienting the reader to the purpose of the chapter, the relationship to previous chapters, and synthesizing concepts woven throughout chapters. These chapters also include an author declaration which outlines the author contributions to paper/manuscript development. Please note, each chapter presents its own references. This is to reflect the compilation nature of the document and the use of publish, submitted or in review papers as thesis chapters.

Chapter	Description
1 Introduction	Introduction to the thesis topic, the aims and objectives of the research, and an overview of the thesis structure.
2 Literature review	Examination of the literature relevant to self-directed learning, health professional practice and health professional programs.
3 Study design and methods	Presentation of the research design and methodology of the PhD study series. Details about the participants, data collection, data analysis are described, and research ethics are discussed.
4 Methods of and factors related to SDLR of students in health professional programs: A scoping review	Presentation of a scoping review paper published in the peer-reviewed journal, <i>Nurse Education Today</i> . The paper examines the factors investigated in the literature for association with SDLR.
5 Psychometric properties of instruments measuring SDLR: A systematic review protocol	Presentation of a systematic review protocol manuscript which has been prepared for submission to the peer-reviewed journal, <i>Systematic Reviews</i> . This chapter presents an examination of literature on instruments measuring SDLR, the rationale for investigation of instrument psychometric properties and the protocol for a systematic review.
6 Explaining variance in SDLR of first year students in health professional programs	Presentation of a manuscript which has been published in the peer-reviewed journal, <i>BMC Medical Education</i> . This cross-sectional study investigated potential determinants of SDLR and the extent to which determinants explain variance in SDLR.
7 Predicting academic performance of first year students in an interprofessional subject	Presentation of a manuscript which has been prepared for submission to the peer-reviewed journal, <i>Journal of Allied Health</i> . This cohort study investigated the association between SDLR and student academic performance in an interprofessional unit.
8 Changes in student SDLR over time in health professional programs	Presentation of a manuscript which has also been prepared for submission to the journal, <i>Journal of Allied Health</i> . This longitudinal study investigated changes in student SDLR over time.
9 Discussion and conclusion	Summary of the key findings and confirmation of the research aims and objectives are presented. This chapter discusses the findings in the context of theoretical frameworks; and considers the implications for research, teaching and practice.
Appendices	Appendices are included at the end of the thesis.

Table 1.4 Chapter summary descriptions.

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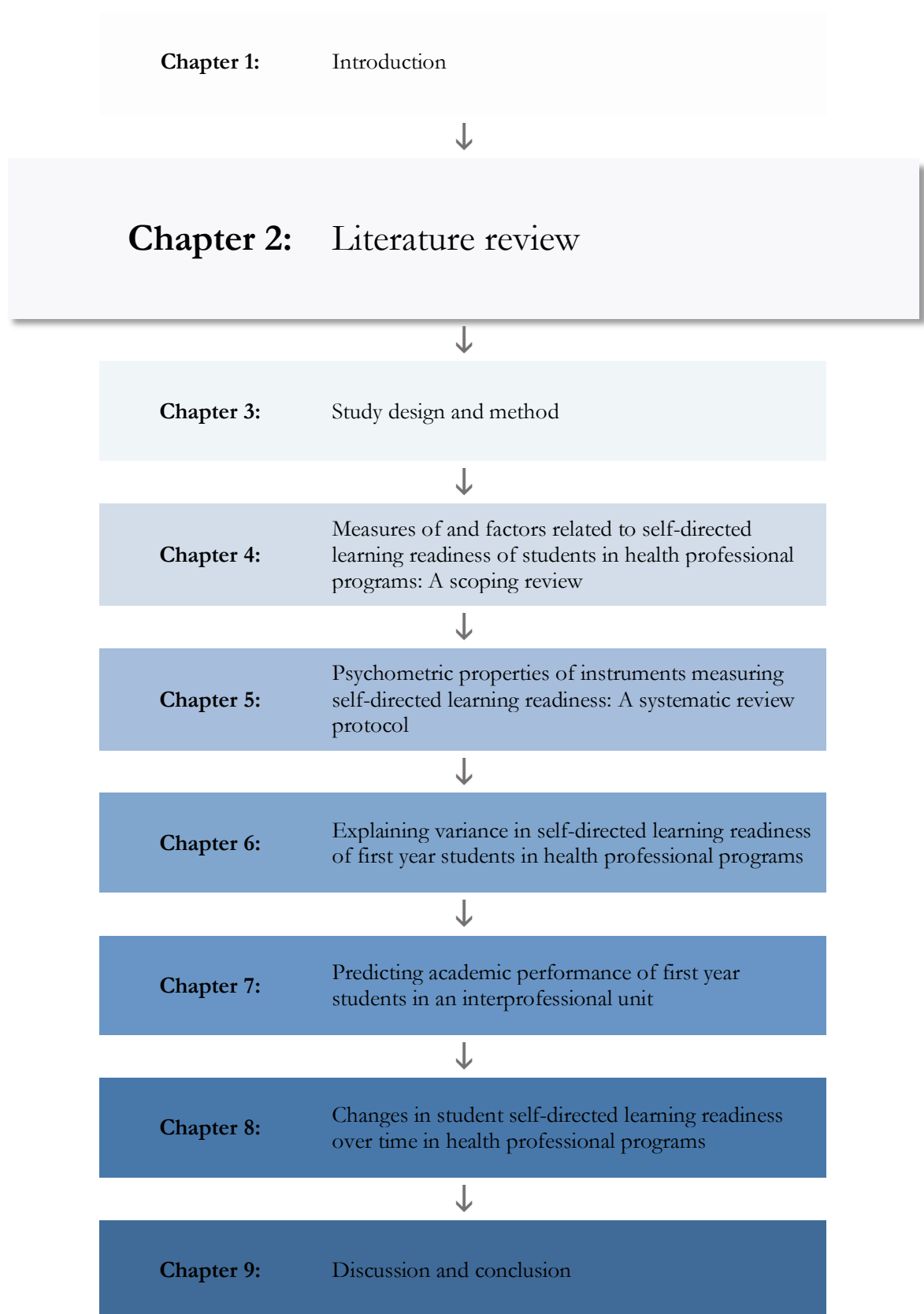


Figure 2.1 Thesis chapter progression: Chapter 2

Chapter 2

Literature review

2.1 Introduction

The health care environment is ever-changing, and health professionals are required to be responsive to these changes in order to deliver high quality health care. Changes in health care practise and practices can be attributed to a wide range of factors. The expanding knowledge base through clinical research, and the development of new technologies often lead to changes in the technique, approach or reasoning practitioners employ in the provision of health care services. These advancements may also influence the scope of professional practice affording health professionals with new opportunities to meet demand in emerging areas. Health professionals also work in health systems which change in terms of governance, service operations, and funding. At a societal level, health professionals work in economic, socio-political and cultural contexts where service recipients and service providers have changing perceptions, needs, knowledge, skills and resources. In order for health professionals to continue to deliver high quality health care in the context of all these changes, it is imperative for health professionals to employ strategies to maintain knowledge and skill currency.

2.2 Knowledge and skill currency

In the health disciplines, maintenance of knowledge and skill currency occurs through continuing professional development (CPD). CPD is a process of lifelong learning where health professionals update their skills, knowledge and attitudes to meet the needs of patients, the health services and their own self-development (Peck, McCall, McLaren, & Rotem, 2000). CPD may focus on clinical, administrative, managerial, educative or interpersonal development required for competent practice. It is often understood to include formal learning opportunities such as courses, workshops or conferences, however, CPD also encompasses learning and development activities such as reflective practice, workplace learning, or activities related to

evidence-based practice. Professional associations or societies have CPD requirements to demonstrate maintenance of professional registration or society membership. But in setting minimum requirements, professional bodies rarely stipulate set curricula; instead they may use activity examples that attract 'points' or hours of CPD. Health professionals, therefore, need to reflect on their own levels of competence, identify their own development needs, determine learning strategies, source learning opportunities, and evaluate the impact of the learning on their practice (Hancox, 2002). Thus, while there are external structures encouraging health professionals to engage in CPD, the process is largely determined and directed by individuals themselves as 'self-directed learners'. To explore the concept further, three CPD approaches will be discussed: evidence based practice, reflective practice and workplace learning.

Evidence based practice

Sackett, Straus, Richardson, Rsoenberg, and Haynes (2000) define evidence-based practice (EBP) as the "integration of best research evidence with clinical expertise and patient values" (p. 1) with the aim being to provide high quality, patient-centered care. In more recent times, this has been recognized to include individual, family and community collaborative or directed care. EBP requires practitioners to adopt a 'problem-solving' approach to the delivery of health care (Stillwell, Fineout-Overholt, Melnyk, & Williamson, 2010) by developing a question, searching and appraising the literature, and integrating this with their practice knowledge and the expertise, goals, and values of the patient/consumer (including knowledge of self and context). Practitioners' commitment to lifelong learning is, therefore, important in EBP, as keeping up-to-date with the advances in the literature is necessary.

Reflective practice

Reflective practice is another form of learning which can be used by health professionals for practice improvement. Osterman and Kottkamp (1993) defined it as "a means by which practitioners can develop a greater level of self-awareness about the nature and impact of their performance" (p.2). Schön (1983) described reflective practice as involving 'reflection-in-action'

and ‘reflection-on-action’. The former, involves the individual reflecting about a situation while still engaged in that action so that the reflection can still influence the outcome. For example, a health professional may reflect on a client’s response and or context of responding midway through completing a clinical assessment and consequently change the administration approach or situation. ‘Reflection-on-action’ involves reflection following an activity or event, to try and make sense of and learn from what happened. Reflective practice is integral to the development of critical thinking, problem solving, self-directed and lifelong learning skills, and it forms the basis of deep learning (Tsingos, Bosnic-Anticevich, & Smith, 2014).

Workplace learning

Lloyd et al. (2014) define workplace learning as “CPD that is stimulated by, and occurs through, participation in workplace activities” (p.134). The health care environment is the context for learning, and the “everyday work of health care” (Manley, Titchen, & Hardy, 2009, p. 113) is the basis for learning. Workplace learning includes a range of activities such as team in-services, clinical supervision or journal club, through to learning from peers or workplace tasks such as clinical audits (Health Education and Training Institute, 2012). Many forms of workplace learning, learning through experience, social interactions or even consulting media sources require individuals to be self-directed in seeking and participating in the learning (Pool, Poell, Berings, & ten Cate, 2016).

In summary, through maintaining professional currency, health practitioners develop their knowledge, skills and attitudes through a variety of learning activities, much of which is self-directed or self-maintained. The need for health professionals to engage in lifelong learning throughout their careers for the benefit of patients and health services is thus evident. As discussed in *Chapter 1*, self-directed, lifelong learning attitudes and skills are typical entry-level new graduate competencies; this is not surprising when the importance of these competencies to underpinning knowledge and skill currency is understood. As such, pre-certification programs need to develop lifelong learning attitudes and skills in students.

2.3 Lifelong learning

Lifelong learning is a concept which has broad interest beyond health professional practice. Veloski and Hojat (2006, p. 133) define lifelong learning as “a concept involving a set of self-initiated activities (behavioral aspect) and information-seeking skills (capabilities) that are activated in individuals with a sustained motivation (predisposition) to learn and the ability to recognize their own learning needs (cognitive aspect)”. As the name suggests, lifelong learning occurs in the context of an individual’s whole life time and may occur in formal, informal or non-formal settings (Cropley, 1980). Lifelong learning, however, is purposeful in nature and is distinct from incidental day-to-day learnings (Matheson & Matheson, 1996). Cropley (1980) states that lifelong learning leads to the systematic acquisition and updating of knowledge, skills and attitudes, in response to changing conditions, with the ultimate goal of promoting self-fulfillment.

In health professional practice, lifelong learning is understood in the context of knowledge and skill currency for high quality care. As previously identified in *Chapter 1*, professional bodies often have requirements for health professionals to actively engage in lifelong learning for maintenance of professional registration (Occupational Therapy Board of Australia, 2012; Physiotherapy Board of Australia, 2015; Podiatry Board of Australia, 2015) or association membership (Australian Health Promotion Association, 2017; Diversional Therapy Australia, 2014; Exercise & Sports Science Australia, 2017).

At a health systems level, various jurisdictions have developed guidelines or frameworks specifically relating to lifelong learning. Locally, for example, a continuing education and training governance framework was developed for public health system in the Australian state jurisdiction of New South Wales (Health Education and Training Institute, 2014). Internationally, a lifelong learning strategic framework was developed for the United Kingdom National Health Service (Department of Health, 2001). Even more reflective of the importance of lifelong learning, the recent High-Level Commission on Health Employment and Economic

Growth (World Health Organization, 2016) made six recommendations for transforming the health workforce, one of which reads:

Scale up transformative, high-quality education and lifelong learning so that all health workers have skills that match the health needs of populations and can work to their full potential. (p.11)

Lifelong learning for health professional practice is thus a policy priority across a range of levels: local, national, international and globally.

There has been discussion in the literature about the fundamental elements of lifelong learning. In the discussion, an individual's ability and motivation to engage in self-directed learning (SDL) activities has generally considered to be a central aspect of lifelong learning (Candy, 1991; Cropley, 1980; Dynan, Cate, & Rhee, 2008; Love, 2011; Organisation for Economic Co-operation and Development, 1998). For example, Dynan et al. (2008) states that "the skill of self-directed learning, if successfully acquired, equips students with the ability to be lifelong learners" (p. 96). Lifelong learning is thus dependent, at least somewhat, on a learners' SDL abilities.

Love (2011) also identified eight characteristics of the post-graduate lifelong learner; several of which relate closely to SDL:

- (the individual) takes responsibility for planning her/his professional career path.
- (the individual) self-assesses, asks other to assess her/him, reflects, and takes learning action based on assessment and reflection.
- (the individual) remains current in her/his field and takes responsibility for identification of knowledge deficiencies and learning opportunities.
- (the individual) has a multiyear professional development (learning) plan.

(Love, 2011, p. 158)

This concept of SDL will be discussed in more detail in the next section (2.4).

Although SDL is considered a critical element of lifelong learning, Candy (1991) also suggests that this relationship between SDL and lifelong learning is also a reciprocal one.

On the one hand, self-directed learning is one of the most common ways in which adults pursue learning throughout their life span, as well as being a way in which people supplement learning received in formal settings. On the other hand, lifelong learning takes, as one of its principle aims, equipping people with skills and competencies required to continue their own self-education beyond the end of formal schooling. In this sense, self-directed learning is viewed simultaneously as a means and an end of lifelong education.

(Candy, 1991, p. 15)

These notions of a relationship between SDL and lifelong learning are echoed in health professional education literature. The interdependence of lifelong learning and SDL is largely discussed in the context maintaining professional knowledge and skill currency (Cadorin et al., 2012; Frambach, Driessen, Chan, & van der Vleuten, 2012; Jacob, McKenna, & D'Amore, 2014; Lunyk-Child et al., 2001; Miller, 2005; O'Shea, 2003). Davis, Taylor, and Reyes (2014) recognized the importance of self-direction as an attribute of lifelong learning, and through Delphi survey of nursing experts, identified 'actively seeking learning opportunities' as an essential characteristic of the lifelong learner. As such, developing the attitudes and abilities for SDL is often considered a critical aspect of preparing students in pre-certification health professional programs for the practice responsibility of lifelong learning.

2.4 Self-directed learning

2.4.1 Development of the SDL concept

Renowned educational theorist, John Dewey posited that "the most important attitude that can be formed is that of the desire to go on learning" (Dewey, 1938, p. 48), thus, setting a context for the exploration of SDL. Much of the foundational work on SDL has been attributed to Cyril Houle. In his text, *The Inquiring Mind*, Houle (1961) classified individuals as 'goal-oriented', 'activity-oriented' or 'learning oriented'. The latter, he suggested, are individuals who continually

seek learning purely for the purpose of learning. Allen Tough, Houles' doctoral student, furthered this work. Tough discussed the concept 'self-teaching' which he described as occurring when individuals "decide to act as (their) own teacher, and assume responsibility for planning, initiating, and conducting the learning project" (Tough, 1967, p. 3) rather than seeking the supervision of a professional instructor.

The concept of SDL, although rooted in the work of Tough, was popularized by Malcolm Knowles in the decade that followed. As part of this work in adult learning, Knowles (1975) defined SDL as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p.18). Knowles found that learners become increasingly self-directed as they mature. He also described several competencies for self-directed learners:

1. understand and articulate the differences between teacher-led and SDL.
2. have self-concept as an independent, self-directing individual.
3. assist peers, and are assisted by peers in the learning process.
4. diagnose their own learning needs.
5. develop learning objectives.
6. relate to teachers as facilitators, helpers or consultants.
7. identify the human and material resources required for learning.
8. use effective strategies for using the learning resources.
9. evaluate accomplishment of the learning objectives. (Knowles, 1975)

After Knowles, SDL has drawn the interest of a number of scholars, and definitions of the concept have become more encompassing. Mezirow (1985) highlighted the importance of cognitive aspects of SDL, such as self-knowledge and critical reflection. Long (1989) stressed the importance of the psychological dimension of SDL, as opposed to the sociological and pedagogical dimensions which Garrison (1997) claimed had largely dominated the literature.

Discussion of self-directedness as a personal attribute or trait relatively stable in an individual's life (Candy, 1991; Oddi, 1987) is an example of the psychological dimension of SDL. In light of the developments in SDL research, it is clear that SDL is multi-faceted and developing understanding of the concept is still underway. To explore these various understandings, the next section (2.4.2) will present three different and influential theoretical models used in SDL research and which inform this study series:

- i) Adult learning theories, specifically Knowles, Holton, and Swanson (2015), which provide a developmental context for SDL and assumptions about both the learner and learning process.
- ii) The *Personal Responsibility Orientation (PRO) model* (Brockett & Hiemstra, 1991) which recognizes the similarities and differences of SDL as an instructional method and personality trait.
- iii) The *SDL Model* (Garrison, 1997) which focusses on the learning process with consideration of the motivational, cognitive and contextual influences on SDL.

2.4.2 Theoretical models of SDL

2.4.2.1 Adult learning theories: Pedagogy versus andragogy

Knowles's early work on SDL (1975), provided a description of the processes and competencies required for SDL. These processes and competencies were developed to guide both the learner and the teacher in enabling effective SDL. Integral to Knowles's understanding of SDL was the notion that SDL is "in tune with our natural processes of psychological development" (Knowles, 1975, p. 14). As individuals mature, they seek independence first from their parents, and then from their teachers. Knowles situated SDL in the context of adult learning; that the aptitude for SDL develops as individuals mature.

Adult learning theories provide an understanding of how adults engage in, experience, and contextualise learning. The first use of the term *andragogy* – that pertaining to adult learning, was by German school teacher, Alexander Kapp (Kapp, 1833). Contemporary understandings of

adult learning have largely derived from Lindeman's (1926) principles, however, adult learning has drawn the attention of numerous scholars. While Malcolm Knowles popularised adult learning theory in North America, there is a "mosaic of theories, models, sets of principles, and explanations" (Merriam, 2001, p3) which combined, provide a broad understanding of how adults learn. Fundamental to adult learning theories is that "the art and science of helping adults learn" (Knowles, 1980, p. 43)– *andragogy*, is distinctly different to helping children learn - *pedagogy*. Initially, Knowles (1978) considered pedagogy and andragogy to be a dichotomy, however, he since recognised that these concepts existed along a continuum (Knowles, 1984). Four assumptions of pedagogy and andragogy were originally described by Knowles (1978), however, these have now been extended to six assumptions in Knowles et al. (2015). A visual representation and summary of these six assumptions of the pedagogy and andragogy continuum was developed by the PhD candidate and is shown in *Figure 2.2*.

While the assumptions pertaining to pedagogy and andragogy are clear, the point at which an individual transitions along the continuum and whether or not transition is inevitable is somewhat unclear. Knowles et al. (2015) considers andragogy in the context of adulthood, and presents four definitions of when individuals become an 'adult':

biological - the age at which individuals can reproduce.

legal - when recognized in the law as being 'of age' (e.g. to vote or obtain a driver's licence).

social - when being performing adult roles, such as being a spouse or full-time worker.

psychological - when one arrives at a self-concept of being responsible for one's own life.

Knowles et al. (2015) suggests that it is the psychological definition which is most pertinent in adult learning. As such, the transition from preferring pedagogical to andragogical approaches will vary between learners, and may take some time. In many settings, there is a clear preference for a particular approach; for example, pedagogical in primary and secondary education, and andragogical in continuing education. In higher education, however, there appears to be a mix of approaches used. From the literature, it is evident that health professional programs employ both pedagogical (Mackintosh-Franklin, 2016) and andragogical (Ferozali, 2011) approaches.

This may suggest that tertiary education is a time of transition. Programs preparing students for adult roles should increasingly adopt andragogical learning approaches and support student developmental transition.

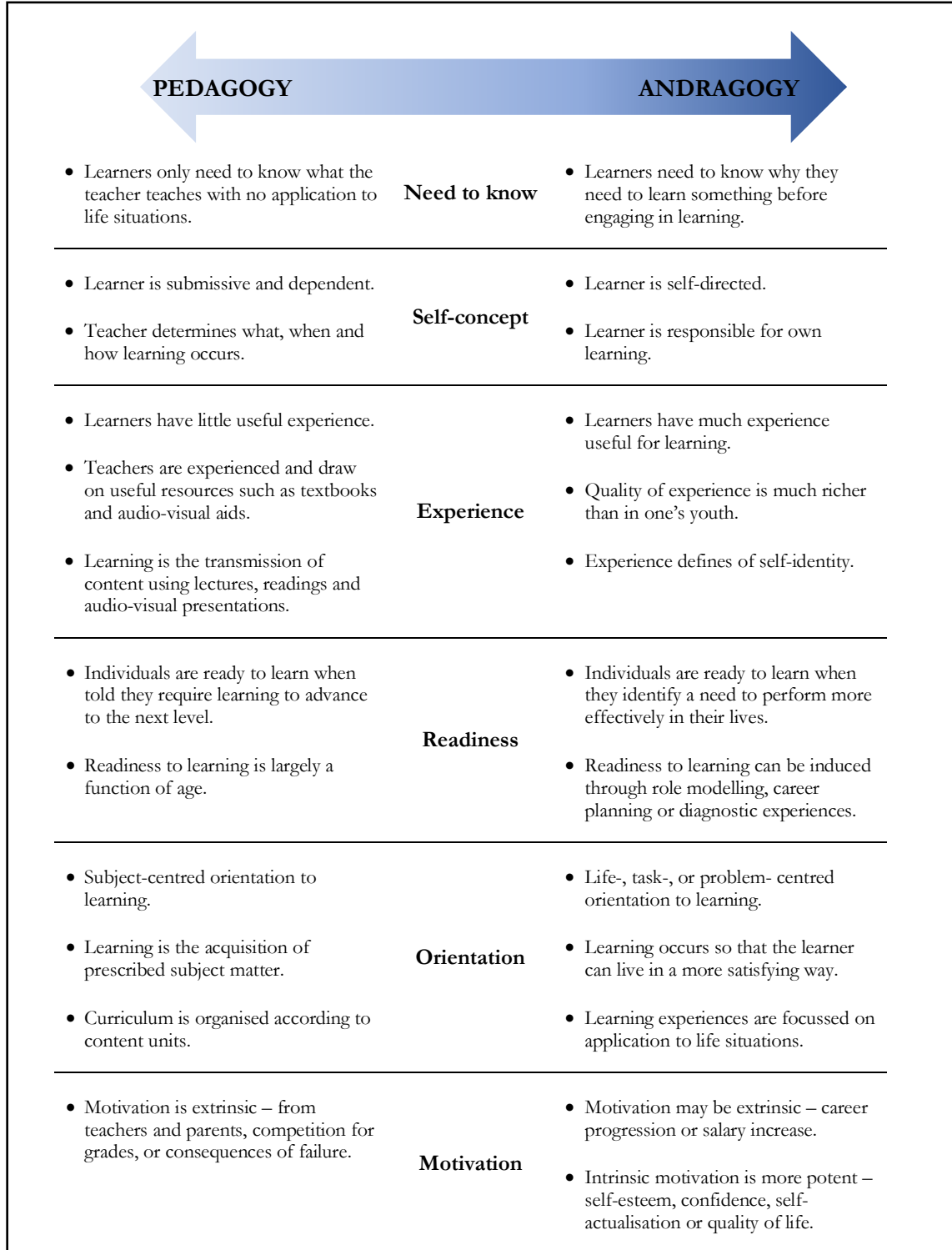


Figure 2.2. Learning assumptions on the continuum from pedagogy to andragogy
This visual representation of the six assumptions of pedagogy and andragogy (Knowles, 1975) was developed by Slater (2018) (the PhD candidate).

2.4.2.2 The Personal Responsibility Orientation (PRO) Model: Self-direction in learning

In the years preceding the development of the *Personal Responsibility Orientation (PRO) Model*, Brockett and Hiemstra noted the dialogue in the literature about whether SDL was an instructional method or a personality characteristic. Initial understandings of SDL, such as those presented by Tough (1979) and Knowles (1975), emphasised the role of the learner in planning, implementing and evaluating learning experiences. More recently, however, there had been discussion in the literature (Candy, 1988; Oddi, 1987) which acknowledged the personality or intrinsic aspects of SDL. In light of this, Brockett and Hiemstra (1991) stated that the term ‘self-directed learning’ was somewhat limiting, merely referring to an instructional approach to learning. Instead, Brockett and Hiemstra proposed that the term ‘self-direction in learning’ was more encompassing of both the instructional and personality dimensions of the concept. They defined ‘self-direction in learning’ as an umbrella concept recognising the “external factors that facilitate the learning taking primary responsibility for planning, implementing and evaluating learning, and internal factors or personality characteristics that predispose one toward accepting responsibility for one’s thoughts and actions as a learner” (Brockett & Hiemstra, 1991, p. 29). Self-direction in learning, is therefore presented as the critical concept in the *PRO Model*, as shown in *Figure 2.3*.

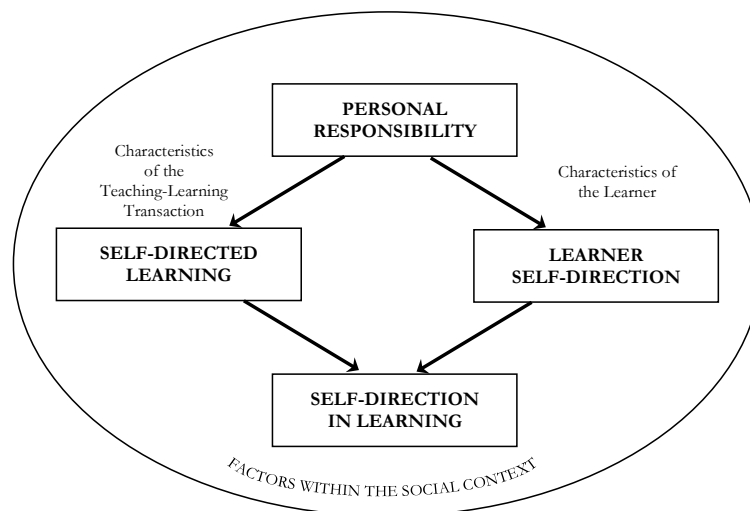


Figure 2.3 The Personal Responsibility Orientation (PRO) Model

From *Self-direction in adult learning: Perspectives on theory, research, and practice* (p. 25) by R.G. Brockett and R. Hiemstra, 1991, New York, NY: Routledge. Copyright by Ralph G. Brockett and Roger Hiemstra. Reproduced with permission.

Brockett and Hiemstra (1991) proposed the departure point for self-direction in learning was that of *personal responsibility*. The willingness and ability of learners to take ownership and responsibility for their own learning was the key determinant of self-direction in learning. The authors iterated that personal responsibility exists along a spectrum where different individuals assume varying degrees of personal responsibility for their learning. While individuals have choices about their own learning, implicit in the concept of personal responsibility is the responsibility of learners to also accept the consequences of their learning, even when that learning leads to discontentment.

As previously mentioned, Brockett and Hiemstra's understanding of *SDL* relates to the instructional aspects of self-direction in learning, particularly the characteristics of the teaching-learning transaction. The authors refer to SDL at the 'process orientation' which focusses on the learning process and encompasses factors external to the learner such as learning resources, the role of the facilitator, and the academic task or assessment.

The third, dimension, learner self-direction, is known as the 'personal orientation' and reflects the "characteristics of an individual that predispose one toward taking primary responsibility for personal learning endeavors" (Brockett & Hiemstra, 1991, p. 29). In light of the discussion in the literature, the authors identified a need to distinguish between SDL as a process, and the personality characteristics which might predispose a learner for SDL. As such, the 'personal orientation' places particular emphasis on the internal factors and "personality characteristics" of the learner (p.29).

The final aspect of the model is the social context which self-direction in learning occurs. While individuals take ownership of their own learning and embark on a journey of self-direction, the learning occurs in a social context. For the student, this may include the institutional environment with concomitant opportunities for, or expectations of self-direction in learning.

In conceptualising four dimensions of self-direction in learning, the *PRO Model* appears to provide a useful framework for understanding the interaction of personal, process and social factors in facilitating SDL.

2.4.2.3 Self-Directed Learning Model

Concerned that previous understandings of SDL focussed on the self-management of learning tasks and inadequately addressed the learning process, Garrison (1997) developed the *SDL Model* which specifically included the cognitive and motivational dimensions of learning. The *SDL Model* is presented in *Figure 2.4* showing three dimensions Garrison proposed to contribute to SDL: motivation, self-management and self-monitoring.

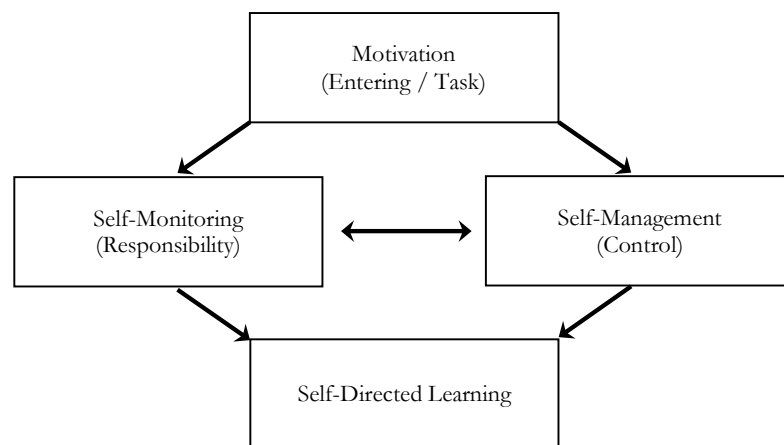


Figure 2.4 Self-Directed Learning Model

From “Self-directed learning: Toward a comprehensive model” by D.R. Garrison, 1997, *Adult Education Quarterly*, 48, p. 18. Copyright by SAGE Publications. Gratis reuse for use in doctoral dissertations.

Garrison defined SDL as “an approach where learners are motivated to assume personal responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing and confirming meaningful and worthwhile learning outcomes” (1997, p.18). His understanding of SDL drew from a ‘collaborative constructivist’ perspective. Garrison discussed this perspective with reference to the individual’s responsibility to construct *meaning* (cognitive) and the confirmation from others that the knowledge was *worthwhile* (social). Learning is both personally meaningful and socially worthwhile.

The *self-management* (task control) dimension of the model pertains to the external activities associated with the learning process, such as management of learning goals, resources and supports (Garrison, 1997). The learner takes control of the method of the learning process. Through a ‘collaborative constructivist’ lens, Garrison proposes that task control does not occur in ‘social independence’ but rather in an environment where there is a collaborative relationship between teacher and learner, through opportunities for sustained communication. Task control also depends on the resources (material, assistive and supportive) which are available and the institutional and learner norms in the educational environment.

Self-monitoring encompasses the cognitive and metacognitive processes required to monitor the learning strategies and “think about our thinking plan” (Garrison, 1997, p. 22). Cognitively, learners self-monitor their progress, review outcomes and develop new strategies to achieve desired outcomes. However, learners also need the ability to be reflective and critical thinkers. Learners need to understand the learning task, search for new information, appraise this information and then reconceptualise their understanding or create a new understanding. Garrison states that it is through self-monitoring that individuals integrate new knowledge with previous experience and, therein, construct meaning.

The third dimension, *motivation*, is critical in the initiation and maintenance of learning (self-monitoring and self-management), and motivation reflects the perceived value of the learning process and outcomes (Garrison, 1997). Learners’ motivation at onset relates influences commitment to the learning goal or outcome. Throughout the learning process, however, learners require task motivation to continue with the learning process and to stay on task. Garrison states that motivation mediates between self-management (task control) and self-monitoring (responsibility). Inherent in motivation, is the learner’s perception of their ability to complete the task, and their perception of having the adequate resources available to complete the task. Lastly, intrinsic and extrinsic motivation needs to be recognised. Garrison argues that intrinsic motivation – driven by one’s own need for satisfaction or fulfilment; is necessary for

meaningful and worthwhile learning, and is a key contributor to continuous learning. Extrinsic motivation – driven by external rewards or pressures; may complement intrinsic motivation, however, may “reduce (the learner’s) willingness to assume responsibility for learning” (Garrison, 1997, p. 29).

The *SDL Model* appears to provide a comprehensive theoretical understanding of SDL and the influences on the learning process however, to date, no study of SDL in the health disciplines has used the model to inform teaching and learning approaches, explain study findings, or attempt to validate the model proposed.

2.4.2.4 *Synthesis of SDL theoretical models*

In presenting the three theoretical models discussed: *adult learning*, *the PRO* and *the SDL model*, it is evident there are similarities and differences in their description of SDL processes and the factors which influence and constitute SDL. Each of the models acknowledges the internal (self-concept, motivation, personal responsibility) and the external (resources, instructional approaches, orientation) aspects of SDL. Inherent in each model is, however, the notion that SDL is learner focussed and learner driven.

The proposed differences in models do, however, have implications for educators regarding how SDL is conceptualised in curriculum development. Knowles (1975) presents a fundamentally developmental understanding of SDL; that as individuals mature and become adults, they have a preference for SDL. Brockett and Hiemstra (1991) emphasise the influence of ‘personality characteristics’ (p. 29) on an individual’s participation in SDL. These two perspectives have implications for educators in determining whether SDL can be learned and taught. If the capacity for SDL is developed simply through maturation, then programs attempting to increase students’ SDL abilities and attitudes will have limited effect or will be mistaken for intervention impact when it is perhaps maturation. The finding from a scoping review of studies of SDL have, for example, often investigated the relationship of time and age,

which appear to have an influence on SDL (Slater & Cusick, 2017). Could this relationship be reflective of maturation? These studies will be further discussed in *Chapter 3*.

Similarly, if some learners are predisposed through personality characteristics to being self-directed learners, then to what extent can programs influence change in students who demonstrate less developed SDL attitudes or abilities? Few studies have explored the influence of personality on SDL behaviours or attitudes. There is indicative evidence that personality factors influence SDL (Johnson, Sample, & Jones, 1988; Leitsch & Van Hove, 1998; Lounsbury, Levy, Park, Gibson, & Smith, 2009), however, there have been no studies of this in the health disciplines. Further research is necessary to determine the influence of personality factors on student SDL, and inform educators on the extent to which SDL is amenable to instruction.

The ‘Big Five’ personality inventory (Goldberg, 1992) measures personality on five domains: ‘extraversion’, ‘conscientiousness’, ‘agreeableness’, ‘emotional stability’ and ‘intellect/imagination’. This instrument is discussed in detail in *Chapter 3* (section 3.5.2) of this thesis. These five personality domains are broad personality markers. John and Srivastava (1999) describe these domains are encompassing the following traits:

- i. *extraversion* traits such as being talkative, energetic and assertive.
- ii. *agreeableness* traits such as being good-natured, cooperative and trustful.
- iii. *conscientiousness* traits such as being orderly, responsible and dependable.
- iv. *emotional stability* traits such as being calm versus neurotic, and not easily upset.
- v. *intellect/imagination* traits such as being independent-minded, open-minded and insightful.

As discussed above, there are no known studies on the influence of personality domains on student SDLR in the health disciplines, and limited studies outside of these disciplines. Given the relevance of several personality traits to SDL, however, the ‘Big Five’ domains may positively influence student SDLR. For example, SDL requires learners to take initiative and responsibility for planning, implementing and evaluating their own learning activities (Knowles, 1975). Personality traits such as being assertive, orderly, responsible and independent-minded,

therefore, appear relevant for SDL. As such, it can be hypothesized that higher scores in the 'Big Five' personality domains 'extraversion', 'conscientiousness' and 'intellect/imagination' may positively influence student SDLR. Given the absence of evidence in the existing literature, this hypothesis requires investigation with students in the health disciplines.

Gap in the literature

There has been no investigation in the health disciplines regarding the influence of personality characteristics on SDLR, despite the inclusion of personality in theoretical models explaining self-direction in learning (PRO Model), and given that Wiley's (1983) definition of SDLR articulates that there are personality characteristics necessary for SDLR. Investigation of personality characteristics as a potential factor influencing student SDLR will identify this relationship and assist educators to understand the degree to which students are predisposed to SDLR, and whether students' SDLR is amenable to instruction.

2.4.3 Self-directed learning readiness

Learners vary in their readiness to engage in SDL. From a developmental understanding of SDL, learners transition from pedagogical to andragogical learning preferences, however, this transition seemingly occurs at different times for different people. Likewise, adopting a personal orientation understanding of SDL, there is diversity across the population as to the personality traits held which may or may not be conducive to SDL. Albeit due to developmental or personality factors, learners vary in their readiness to engage in SDL, both in attitude and skill. Wiley (1983) described this self-directed learning readiness (SDLR) as the degree to which an individual possesses "the attitudes, abilities and personality characteristics necessary for self-directed learning" (p. 182). SDLR, therefore, is the precursor for SDL. Readiness for SDL requires learners to have positive attitudes towards taking initiative for their learning, the awareness of how they can approach their independent learning, and the self-efficacy that they have competence in attending to their own learning needs. SDL, therefore, relates to learners'

skills and behaviours in the diagnosis of their learning needs, formulation of learning goals, identification of human and material resources for learning, selection and implementation of appropriate learning strategies, and evaluation of learning outcomes (Knowles, 1975). Understanding students' SDLR can be useful in identifying when teaching and learning approaches requiring competence in SDL should be placed in the curriculum, or in identifying students who might require support with approaching SDL activities.

2.4.3.1 *Self-directed learning readiness measures*

Guglielmino (1978) was the first to develop an instrument to measure SDLR, titled the Self-Directed Learning Readiness Scale (SDLRS). Since then, several other instruments have been developed, namely Oddi's Continuing Learning Inventory (OCLI) (Oddi, 1986); Ryan's two part self-assessment questionnaire (Ryan, 1993); the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher, King, & Tague, 2001) and the Self-Directed Learning Instrument (SDLI) (Cheng, Kuo, Lin, & Lee-Hsieh, 2010). To date, however, there has not been a comparative study of these instruments. Detailed exploration of the instruments measuring SDLR used in the literature is presented in *Chapter 5*.

Gap in the literature

There has been no survey of all instruments used to assess the SDLR of students in the health disciplines. Nor has there been a systematic review of the psychometric properties of those instruments.

2.4.3.2 *SDLR and lifelong learning*

It was previously established (section 2.3) that SDL and lifelong learning were related to maintenance of professional currency. Pre-certification programs thus have accreditation requirements relating to development of SDL and/or lifelong learning attitudes, knowledge and skill. Few studies have investigated SDLR of qualified health professionals, but there is indicative evidence of SDLR influencing professional competency in nursing (Park, Chung, &

Kim, 2016) and of SDLR, particularly the ‘desire to learn’, influencing qualified physical therapists’ propensity to adopt EBP (Bridges, Bierema, & Valentine, 2007).

Health professional programs, however, have had great interest in understanding SDLR of pre-certification students. Studies in health professional programs indicate that there are wide-ranging degrees of student SDLR at the commencement of programs (Davis & Pearson, 1996; Gyawali, Jauhari, Shankar, Saha, & Ahmad, 2011; Kell & van Deursen, 2002). As such, there has been research attention investigating the factors which may influence students’ SDLR on entry into programs (Slater & Cusick, 2017), and whether students’ SDLR changes as they progress through their program (Duman & Sen, 2012; El-Gilany & Abusaad, 2013; Harvey, Rothman, & Frecker, 2003; Huynh et al., 2009; Kell, 2006; Malta, Dimeo, & Carey, 2010; O’Kell, 1988; Phillips, Turnbull, & He, 2015; Yuan, Williams, Fang, & Pang, 2012).

Detailed analysis of the factors investigated for association with student SDLR is presented in *Chapter 4*, however, it is noteworthy that to date a broad range of factors have been investigated for association with SDLR, and that investigation of these factors has been ad hoc, rather than strategic. As discussed in *Chapter 1* (Section 1.2), investigation of factors influencing SDLR has largely occurred in nursing and medical cohorts, with many allied health or other health disciplines having no student SDLR data. An additional challenge in the allied health disciplines, is the small cohort sizes as compared to medicine and nursing. In the allied health disciplines, given the small sample sizes, studies have not been large enough to develop explanatory models of SDLR variance.

Gap in the literature

Investigation of factors associated with change in SDLR has been ad hoc. A review of factors is necessary to determine which factors have previously demonstrated association with SDLR change.

Gap in the literature

Despite having the same professional drivers for SDL as medicine and nursing, there have been very few studies of SDLR in allied health and other health disciplines. Those that have been conducted have been too small to develop adequately powered exploratory models of SDLR variance. Larger studies are required to better understand the interplay of student, disciplinary and SDLR factors to ultimately inform curricular approaches with these cohorts.

2.4.4 Utility of SDLR

While development of SDLR is important for professional practice, educators have also had interest in SDLR as a potential factor associated with academic success and/or course performance. It could be hypothesized that a student's SDLR is indicative of his/her self-management and/or self-monitoring, and potentially, the impact these have on academic performance. SDLR may be useful in identifying students who require additional supports with their studies. Equally, SDLR may indicate the extent to which a student has the "attitudes, abilities and personality characteristics" (Wiley, 1983, p.182) to attain competence in an important pre-certification program requirement.

In the health disciplines, the association between SDLR and academic performance has been measured using a number of proxy measures including grade point average (GPA), examinations, subject results and clinical clerkships. SDLR has been positively associated with GPA (Alotaibi, 2016; Linares, 1999) and subject results (Davis & Pearson, 1996), however, this has not been consistent across studies (Deyo, Huynh, Rochester, Sturpe, & Kiser, 2011; Monroe, 2016). SDLR has also been shown to be indicative of student performance in clinical clerkships (Shokar, Shokar, Romero, & Bulik, 2002). Studies exploring the influence of SDLR on examination results, however, have not found a significant relationship (Deyo et al., 2011; Monroe, 2016). When reflecting on these findings, it should be noted that examination results relate to performance on one assessment task, whereas GPA, subject results and clerkship

evaluations include cumulative results over a number of assessment tasks. As SDLR shows association with GPA and subject results, this may suggest that the influence of SDLR on academic performance is identifiable in holistic or aggregate evaluations of student academic performance, rather than performance on a single assessment task.

There has been limited investigation of the relationship between SDLR and academic performance in the health disciplines. Studies have largely occurred in single discipline samples in medicine and nursing student cohorts (Abraham et al., 2011; Alotaibi, 2016; Davis & Pearson, 1996; Monroe, 2016; Shokar et al., 2002). The only studies in other disciplines have been in pharmacy (Deyo et al., 2011), and a multidisciplinary study including occupational therapy and physical therapy (Linares, 1999).

Gap in the literature

There have been few studies on the relationship between SDLR and academic performance in allied health disciplines. Investigation of this relationship is necessary to better understand the utility of SDLR in academic outcomes of interest to programs.

2.5 SDL in health professional curricula

Health professional programs have responsibility for students meeting entry-level competencies by the time they complete of their training. Self-directed, lifelong learning attitudes and abilities are common entry-level competencies in health professions as has been outlined in *Tables 1.2* and *1.3* in the previous chapter. The assumption of these entry-level graduate competencies is that programs will provide the learning experiences and attribute assessment to support student's self-directed and lifelong learning attitudes and abilities needed in graduate practice. The previous section (2.4.2) outlined three models relevant to understanding factors and processes in SDL; however a model that conceptualizes how SDL abilities can be developed through curricula is the Staged Self-Directed Learning Model (Grow, 1991).

2.5.1 Staged Self-Directed Learning Model

The Staged Self-Directed Learning Model was developed by Gerald Grow from his experience teaching students in higher education settings. The model (Grow, 1991) infers that programs can influence change in students' SDL abilities and more so that the goal of the educational process is to develop self-directed, lifelong learners. To the point, Grow argues that just as dependency can be learned, so too can self-direction – and it can be taught. This contrasts with the notion that preferences for SDL develop with maturation (*adult learning theories*), and that personality traits may predispose an individual to taking responsibility for their learning (*PRO Model*). While this model has broad application to higher education teaching and learning approaches, it is of particular relevance in the health disciplines given that disciplinary accreditation standards often explicitly require programs to develop students' self-directed, lifelong attitudes and abilities in preparation for professional practice. Grow's Staged Self-Directed Learning Model presents four stages that characterize the roles of student and teacher (*Table 2.1*).

Stage	Student	Teacher	Examples
Stage 1	Dependent	Authority, Coach	Coaching with immediate feedback. Drill. Informational lecture. Overcoming deficiencies and resistance.
Stage 2	Interested	Motivator, Guide	Inspiring lecture plus guided discussion. Goal-setting and learning strategies
Stage 3	Involved	Facilitator	Discussion facilitated by teacher who participates as equal. Seminar. Group projects.
Stage 4	Self-directed	Consultant, Delegator	Internship, dissertation, individual work or self-directed study group.

Table 2.1 The Staged Self-Directed Learning Model (Grow, 1991).

From “Teaching learners to be self-directed” by G.O. Grow, 1991, *Adult Education Quarterly*, 43, p. 125. Copyright by SAGE Publications. Gratis reuse for use in doctoral dissertations.

At Stage 1, learners are dependent and rely on a teacher-centred approach to learning. Stage 2 learners become more interested in learning, and engage well when they understand the purpose of the learning activities. Learners at Stage 3 have developed knowledge and skills in an area, but may need to develop self-concept or confidence in their own abilities. Lastly, learners at Stage 4 independently set their own goals, and assume responsibility for their own learning, drawing from teacher's expertise when they identify a need. This staged model indicates cumulative development of SDL abilities, which can inform teaching and learning approaches across the curriculum.

The Staged Self-Directed Learning Model has received some criticism particularly for being too simplistic and describing some teaching styles as "lower level" and others as high (Tennant, 1992). Grow (1994) responded to this criticism and disagreed stating that the model maps useful concepts using clear writing, as models should; and that this should not to be mistaken for simplistic thinking. Grow also pointed out that the teaching styles identified in the model were not classified as low or high, they were arranged to demonstrate when different teaching styles are appropriate. Grow was receptive, however, to Tennant's suggestion that a mismatch between teacher and student's styles may in fact be beneficial at times.

Implicit in the four-stage model is the assumption that that, teaching and learning approaches which recognize teacher/student roles and foci can prepare students to become more self-directed in their learning. The model supports the idea that attitudes and abilities for SDL can be developed in programs, through targeted teaching and learning activities. While not evaluated, there is only one known application of this model informing curricular approaches in the health disciplines (Smits & Ferguson, 2000).

2.5.2 Teaching and learning approaches supporting SDL development

Many health professional programs have moved away from traditional didactic teaching and learning methods; instead employing approaches which are assumed to require or are recognized

as requiring competence in SDL, often for the purpose of preparing students for the professional responsibility of lifelong learning. Such approaches used in health professional programs include problem based learning (Chung, 2001; Norman, Wenghofer, & Klass, 2008), team based learning (Cheng et al., 2014; Roh, Lee, & Choi, 2015), flipped classrooms (Gubbiyappa, Barua, Das, Murthy, & Baloch, 2016; Janotha, 2016), online learning (White & Cheung, 2006), and with activities explicitly addressing SDL, such as SDL packages (Nixon & Morgan, 1996; Zhang, Zeng, Chen, & Li, 2012).

In the literature, evaluation of these approaches has often looked at outcomes such as student academic performance (Van Berkel & Dolmans, 2006; White & Cheung, 2006; Xu, Martin, & Gribbins, 2010), satisfaction with learning experiences (Costa, Van Rensburg, & Rushton, 2007; Spiers et al., 2014; Zhang et al., 2012), or self-assessment of SDL abilities (Barrow, Lyte, & Butterworth, 2002; Chiang, Leung, Chui, Leung, & Mak, 2013). Others have employed qualitative approaches to gain an understanding of student or faculty perceptions of the learning experience as it relates to SDL (Green & Schlairet, 2017; Tao, Li, Xu, & Jiang, 2015). While investigation of teaching and learning approaches with known outcomes or perceptions is important, the examination of SDL development in the context of discipline-specific curriculum may best be achieved through evaluation of students' perceptions of SDLR. Each of the teaching and learning approaches previously explored in relation to SDL/SDLR is now briefly described.

2.5.2.1 Problem-based learning

Problem-based learning (PBL) has been a widely adopted teaching and learning approach in health professional programs. In PBL, students work in groups with a problem case or scenario. Students determine their own learning objectives, then independently engage in self-directed study to acquire necessary knowledge, before discussing and refining new learning in groups (Wood, 2003). A number of studies (Malta et al., 2010; Rezaee & Mosalanejad, 2015; Tsou et al., 2009) have shown evidence of student SDLR increasing over the course of a PBL curriculum.

When compared with traditional methods of instruction, however, studies have found no significant differences between learning approaches (Kell & van Deursen, 2002, 2003) or there has been indication that traditional approaches may have greater effect on student SDLR (Devi, Devan, Soon, & Han, 2012). There appears to be only one known study in the health disciplines which found a decrease in student SDLR over a PBL curriculum (Walker & Lofton, 2003). While there is promise in PBL as an approach to increase student SDLR, it is inconclusive whether PBL is more effective than other approaches.

2.5.2.2 Online learning

Online learning, often called e-learning, refers to learning which occurs in part or entirely over the internet (Means, Toyama, Murphy, Bakia, & Jones, 2009). When coupled with face-to-face instruction, it is commonly known as blended learning. Online learning approaches are mostly asynchronous, and require learners to assume greater responsibility for monitoring and managing the cognitive and contextual aspects of their learning (Garrison, 2003). Examples in the literature have shown students in health professional programs having higher SDLR following the implementation of a web-based learning course (Şenyuva & Kaya, 2015) and use of an electronic reflective practice exercise (Mori, Batty, & Brooks, 2008). When compared with traditional teaching methods, Gagnon, Gagnon, Desmartis, and Njoya (2013) found no significant differences in SDLR change between approaches. When controlling for motivation, however, students with low and medium SDLR on entry had a greater increase in SDLR with traditional teaching methods, whereas students with high SDLR had a greater increase through blended learning. This suggests there is a need for programs to employ different educational methods given the diversity in approaches to learning across the student cohort.

2.5.2.3 Team based learning

Team-based learning (TBL) is “a particular instructional strategy that is designed to (a) support the development of high-performance learning teams, and (b) provide opportunities for these team to engage insignificant learning tasks” (Fink, 2002, p. 8). In TBL, students learn in self-managed groups. Before in-class learning activities, students conduct self-directed study related

to the course content. They then complete a short test of key concepts, first individually, then as a group, with an opportunity to clarify misconceptions with an instructor. Following this, they participate in problem-based class activities (Parmelee & Michaelsen, 2010). Few studies in the health disciplines have investigated the effect of TBL on student SDLR. Cheng et al. (2014) found that TBL had a positive influence on SDLR. Badiyepeymaie Jahromi, Mosalanejad, and Rezaee (2016) compared TBL to a web-based teaching technique, however found no significant differences between approaches in total SDLRS. Further enquiry into the influence of TBL on SDLR is needed.

2.5.2.4 Flipped classrooms

In the ‘flipped classroom’, students independently interact with learning materials and resources outside of class time, and then participate in active, often collaborative, problem-based activities in class (Herreid & Schiller, 2013). A number of studies (Green & Schlairet, 2017; Gubbiyappa et al., 2016; Janotha, 2016; Schlairet, Green, & Benton, 2014) have implemented flipped classroom approaches in health professional programs and note the requirement for student competence in SDL, however, none have evaluated student SDLR over the course of the curriculum. This warrants further research attention.

2.5.2.5 Activities explicitly addressing SDL

Many health professional programs have implemented a range of activities specifically targeting student SDL. These activities have included SDL packages which contain selected readings, coursework, resources or assessment tasks (Nixon & Morgan, 1996; Xu et al., 2010; Zhang et al., 2012), discussion based lectures facilitating SDL outside of the classroom (Costa et al., 2007), and a workshop series which specifically aimed to increase student SDL abilities (Tao et al., 2015). Interestingly, none of these studies measured student SDLR, however there was a significant increase in SDL abilities following the workshop series (Tao et al.).

2.5.2.6 *Synthesis of the influence of different education methods on SDLR*

Given insufficient evidence in the literature, as described above, further work is required to determine the influence of the above educational methods on student SDLR. To date, the influence of a PBL curriculum on student SDLR has received the most research attention in the health disciplines, and there are promising findings which may suggest that a PBL curriculum does increase student SDLR over time. The other educational methods discussed (online learning, team-based learning, flipped classrooms, and SDL activities) have limited evidence of a positive influence on student SDLR. To date, there has been no known study which has specifically investigated more than two educational methods for comparison. Further investigation of how these educational methods influence student SDLR over time is necessary to inform curricular approaches used to develop students' self-directed, lifelong learning abilities; a requirement of accreditation standards, as discussed in *Chapter 1* of this thesis.

2.5.3 **Assessment as a driver for SDLR**

In addition to different education methods, various assessment methods may also enhance student SDLR. Often in higher education, assessment of student learning is completed by the teacher through examination, written assignments or demonstration of practical skill. In SDL theory, self-directed learners take initiative for their own learning, diagnose their learning needs, implement educational strategies and evaluate their own learning (Knowles, 1975). Therefore, teacher-led assessment may not be optimal in enhancing student SDLR. Daniels and Magarey (2000) argue that self-assessment and peer-assessment are important strategies for developing students' abilities for self-directed lifelong learning. As described by Hanrahan and Isaacs (2001), *self-assessment* is when students assess their own work, and *peer assessment* when they assess the work of others. In the health disciplines there has been little investigation of self- and peer-assessment as a method of developing student SDLR; however, these approaches may be embedded in education methods such as PBL and TBL. Further exploration of how self- and peer- learning (as opposed to traditional teacher-led assessment) influences the development of student SDLR is warranted.

2.6 Summary of gaps in the existing literature

The literature review identified a number of gaps in the body of knowledge:

1. *Despite having the same professional drivers for SDLR as medicine and nursing, there have been very few studies of SDLR in allied health and other health disciplines. Those that have been conducted have been too small to develop adequately powered exploratory models of SDLR variance. Larger studies are required to better understand the interplay of student, disciplinary and SDLR factors to ultimately inform curricular approaches with these cohorts.*

It is important to address this gap in the literature because accreditation standards of many health disciplines other than medicine and nursing also require education programs to develop students' self-directed learning abilities. Of the few studies in the allied health disciplines, sample sizes have been much smaller than in medicine and nursing which often have large student cohort sizes. Studies with larger sample sizes in these disciplines may better identify relationships between SDLR and factors of interest.

2. *Investigation of factors associated with change in SDLR has been ad hoc. A review of factors is necessary to determine which factors have previously demonstrated association with SDLR chan*

To date, there have been a wide variety of factors investigated for relationships with SDLR. A review of the factors investigated in the literature will help identify those factors which have nascent evidence of influencing SDLR. This type of review will assist researchers in making strategic selections of factors to include in future studies investigating student SDLR.

3. *There has been no investigation in the health disciplines regarding the influence of personality characteristics on SDLR, despite the inclusion of personality in theoretical models explaining self-direction in learning (PRO Model), and given that Wiley's (1983) definition of SDLR articulates that there are personality characteristics necessary for SDLR. Investigation of personality characteristics as a potential factor influencing student SDLR will identify this relationship and assist educators to understand the degree to which students are predisposed to SDLR, and whether students' SDLR is amenable to instruction.*

It is surprising that personality has not previously been investigated for association with SDLR, when personality has been identified as a critical factor in SDL theoretical models. It is important to address this gap in the literature to identify whether personality does in fact influence SDLR. This will inform educators about the degree to which SDLR can be taught. If personality factors, which are stable over time, account for much of the variance in student SDLR, then there will be considerable implications for educational programs and several accreditation standards relating to the development of students' self-directed, lifelong learning attitudes and abilities.

4. *There has been no survey of all instruments used to assess the SDLR of students in the health disciplines. Nor has there been a systematic review of the psychometric properties of those instruments.*

In the literature, there has been some debate over the validity of instruments used to measure SDLR. Consequently, a range of instruments have been used in the literature. It is important that researchers use instruments which provide valid and reliable findings. A systematic review of psychometric properties of these instruments will inform instrument selection by researchers in future studies.

5. *There have been few studies on the relationship between SDLR and academic performance in allied health disciplines. Investigation of this relationship is necessary to better understand the utility of SDLR in academic outcomes of interest to programs.*

While student SDLR has been of interest to researchers and educators in the health disciplines, it has been infrequently investigated for a relationship with student academic performance. It can be hypothesized that students with higher SDLR have higher academic results as they will take initiative for their own learning, identify gaps in their own knowledge, and sources additional education resources to address these gaps. Conversely, students with lower SDLR may require additional assistance to support academic achievement. It is, therefore, important to address this gap in the literature to inform educator and program approaches to supporting academic performance.

These gaps informed the development of the objectives in the current PhD study series:

- 1. To determine the factors which influence SDLR of students in health professional programs.**
- 2. To explore the attributes of instruments used to measure SDLR of students in health professional programs.**
- 3. To determine whether or not SDLR changes from a baseline of first year, first semester, to third year, second semester.**
- 4. To determine the influence of student SDLR on academic performance.**

In light of the literature review and the above summary of the gaps in the literature, these objectives provide a framework for in-depth investigation of SDLR: the factors which influence it, the instruments which measure it, the degree to which it changes over time, and the outcomes of interest it may influence. For several of the health disciplines included in the current PhD study series, there is no existing evidence in the literature relating to student SDLR despite these disciplines having professional and accreditation drivers for developing students' self-directed, lifelong learning attitudes and abilities. Meeting these objectives will provide comprehensive, baseline data for these disciplines and will identify relationships which may inform teaching and learning approaches.

2.7 Study series contextual framework

Through implementing targeted teaching and learning approaches it is hoped that programs will effect a positive change in students SDLR, and their ability to be self-directed, lifelong learners. The Grow (1991) four-stage model assumes such cumulative change should be reflected in curricula. The Input-Environment-Outcome (I-E-O) model (Astin, 1993) is a useful conceptual framework to understand these desired changes, and the extent to which both program efforts

and student attributes contribute to the change. Astin (1993) developed the I-E-O model as a framework for analysing student outcomes in higher education. The model is comprised of three constructs: *inputs* (student characteristics), the *environment* (educational context) and student *outcomes*. The model serves to measure relevant input characteristics of students, and then correct for these input differences when determining the environmental effects on outcomes (Astin, 2012). Representation of the model is illustrated in *Figure 2.5*.

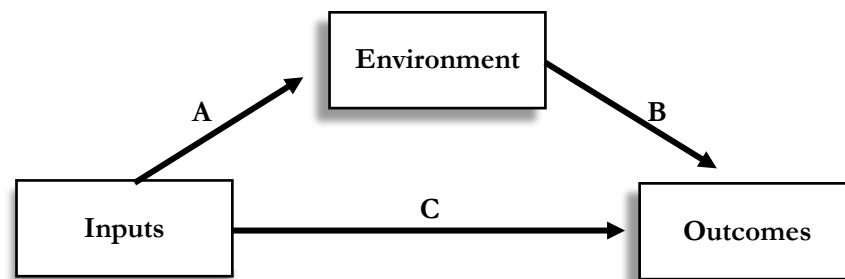


Figure 2.5 Input-Environment-Outcome Model (Astin, 2012)

From *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education* (2 ed.) (p. 28) by A.W. Astin, 2012, Lanham, MD: Rowman & Littlefield Publishers. Copyright by Rowman & Littlefield Publishers. Reproduced with permission.

In the model, *outcomes* refer to the ‘talents’ that programs and/or institutions attempt to develop, change or influence through student experiences during the course of their program (Astin, 2012). These outcomes may be varied ranging from particular student learning outcomes in knowledge and skill, to the development of specific attitudes and values, or more broadly to institutional outcomes such as student retention rates.

Environment refers to all that might happen to a student during their enrolment, which might influence student outcomes of interest. Astin (2012) states that assessment of the environment may consider the effects of different institutions on student outcomes, ‘between-institution’; or the effects of students’ experiences which occur ‘within-institutions’. For example, ‘between-institution’ inquiry may compare the effect of differing institutions by considering structural characteristics such as size, geographic location, selectivity, or resources. ‘Within-institution’ inquiry may compare differing programs, perhaps looking at class sizes, units or teaching

methods. It too, however, may consider other educational experiences students have such as differences in student use of campus facilities or support services.

Inputs are the attributes students have on entry to the program. These may include demographic factors such as age and gender; academic factors such as performance on admissions tests or prior education; or other factors such as personality, values or expectations students have on entry (Astin, 2012).

The relationships between inputs, the environment and outcomes are illustrated in the model by the arrows labelled A, B and C. These relationships can be explained as follows:

- A** Differences between students may affect the way they interact with the environment.
- B** Differences in student experiences may influence outcomes.
- C** Differences between students may show consistency over time and influence outcomes.

In the current study series, the I-E-O model was used as a conceptual framework to guide the development of the study series. The *outcome* of interest was student SDLR, the *inputs* were the attributes students had on entry to their program which may influence SDLR, and the *environment* was the educational experiences students had during the course of their program which may influence SDLR. The models reviewed in sections 2.4 and 2.5 informed understandings of the outcome of interest (SDLR) and environment (discipline and program) respectively. Further detail of the input, environment, and outcome measures used in the current study series are presented in *Chapter 3*.

2.8 Chapter synopsis

Health professionals have a responsibility to maintain knowledge and skill currency. To do so, they need to have attitudes and abilities for self-directed, lifelong learning; that is, to identify their own learning needs, develop strategies to address these learning needs, implement the strategies and then evaluate the learning. Lifelong learning and SDL have long been discussed in

educational literature, and a number of theories have been developed to understand these concepts. Theories have suggested several factors influencing SDL practices: *personal factors*, such as motivation or attitudes; *developmental factors*, particularly relating to the transition to adulthood; *external factors*, such as resources, or learning environments, and *personality factors or traits*. SDL has been of much interest in health professional programs. Programs have inquired as to how best develop SDL attitudes and abilities in students. Various teaching and learning approaches have been implemented which have either necessitated or anticipated higher degrees of SDL. These approaches include PBL, online learning, team-based learning, flipped classrooms, and targeted SDL activities. Several gaps in the knowledge base were identified in this literature review. These gaps informed the development of four study objectives. The study series adopted the I-E-O model as contextual framework guiding the development of the study.

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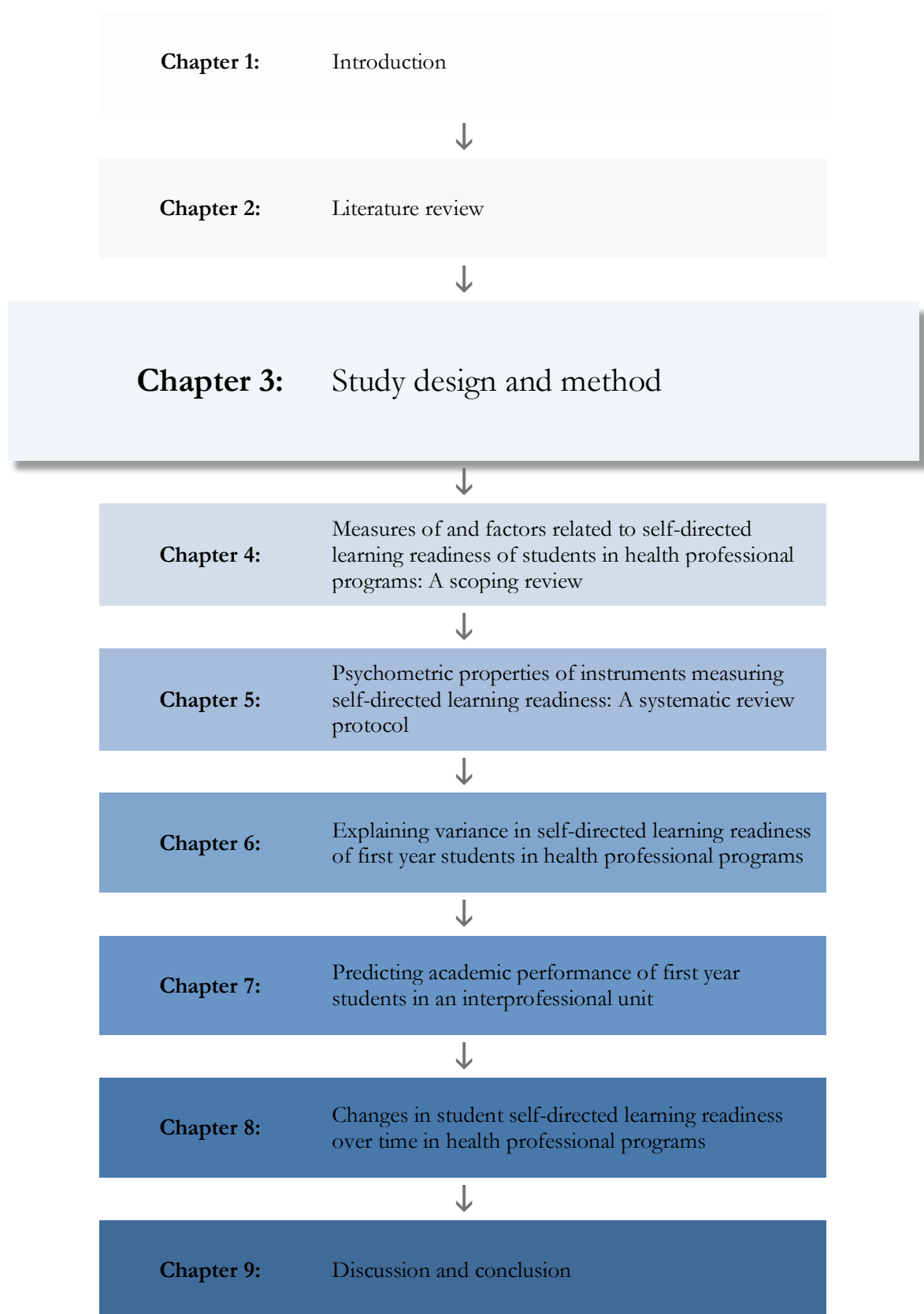


Figure 3.1 Thesis chapter progression: Chapter 3

Chapter 3

Study design and method

3.1 Introduction

To gain an in-depth understanding of student SDLR in health professional preparation programs, a series of five studies was developed which addressed the four research objectives of the PhD study series. The studies and their target objectives are presented in *Table 3.1*.

	Study type	Study	Primary research objective (RO)
Literature reviews	Scoping review	<i>Chapter 4</i> - Factors related to SDLR of students in health professional programs: A scoping review.	RO 1 - To determine the factors which influence SDLR of students in health professional programs.
	Systematic review justification and protocol development	<i>Chapter 5</i> - Psychometric properties of instruments measuring SDLR: A systematic review protocol.	RO 2 - To develop a protocol to explore the attributes of instruments used to measure SDLR of students in health professional programs.
Observational studies	Cross-sectional survey study	<i>Chapter 6</i> - Explaining variance in SDLR of first year students in health professional programs.	RO 1 - To determine the factors which influence SDLR of students in health professional programs.
	Cohort study	<i>Chapter 7</i> - Predicting academic performance of first year students in an interprofessional unit.	RO 4 - To determine the influence of student SDLR on academic performance.
	Cohort Study	<i>Chapter 8</i> - Changes in student SDLR over time in health professional programs.	RO 3 - To determine changes in students' SDLR between first year, first semester and third year, second semester.

Table 3.1 Overview of the PhD study series.

3.2 Research methods

3.2.1 Scoping review

Scoping reviews, also known as scoping studies, are a “form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (Colquhoun et al., 2014, p. 1294). They allow for a broad exploration of a topic, often focusing on the “volume, nature, or characteristics” presented in the literature (Arksey & O'Malley, 2005, p. 30). Unlike systematic reviews, scoping reviews do not attempt to critically appraise the quality of the evidence, but rather provide an overview of the existing literature. In this sense, they are useful when a topic has not been comprehensively reviewed or when the topic is complex (Pham et al., 2014). As an emerging methodology, scoping reviews have increasingly been used over the past decade (Colquhoun et al., 2014). The Arksey and O'Malley (2005) framework together with Levac, Colquhoun and O'Brien's (2010) enhancements provide methodological guidance for conducting scoping reviews, such that the process is transparent and replicable. Scoping review methodology was used in the current PhD study series to identify all the factors which have previously been investigated in the literature for potential association with SDLR.

3.2.2 Systematic review (justification and protocol development)

Systematic reviews attempt to “collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question” (Higgins & Green, 2011, para. 1). They comprehensively locate all existing research which meet eligibility criteria through systematic, replicable search and selection methods. Studies included in the review are then assessed for methodological quality and validity of the findings, before the findings are systematically synthesised, at times through meta-analysis (Higgins & Green, 2011). Through using transparent and systematic methods, systematic reviews limit bias and allow researchers to draw reliable and accurate conclusions (Gopalakrishnan & Ganeshkumar, 2013). These findings are more generalizable than those from individual studies. As publication of studies is often influenced

by the study outcomes, publication bias may, however, have an influence on systematic reviews (Gopalakrishnan & Ganeshkumar, 2013).

An essential component of the systematic review process is the development of a systematic review protocol (Moher et al., 2015). Protocols: (a) promote the development of a carefully considered plan prior to implementation, (b) ensure the methods used in the review are transparent and replicable, (c) enable others to appraise the methodology, and (d) prevent arbitrary decision making (Shamseer et al., 2015). Moher, Tetzlaff, Tricco, Sampson, and Altman (2007), however, found that few published systematic reviews reported working from a protocol. In recent times, there has been increasing recognition of the importance of the systematic review protocol, and considerable efforts to improve protocol documentation and availability (Shamseer et al., 2015). Since 2011, an international, prospective register of systematic review protocols, PROSPERO (www.crd.york.ac.uk/prospero/) has been launched, as well as the first open access journal publishing high quality systematic review products (including protocols), *BMC Systematic Reviews*. Publication of the systematic review protocol in publicly accessible forums may reduce the duplication of research efforts, and identify selective reporting through comparison of the completed review with the protocol (Shamseer et al., 2015).

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) (Moher et al., 2015) provides guidance on best practice protocols for conducting systematic reviews. The PRISMA-P lists 17 recommended items to address in a systematic review protocol. Moher et al. (2015) recommend that systematic reviews are prospectively registered with an agency, such as PROSPERO, prior to the implementation of the review, and detail information to be included in the protocol for transparency (e.g funding and sponsors) and the methods, set a priori, to enable replication.

In keeping with best practice, a systematic review protocol was developed in the PhD study series to investigate the psychometric properties of instruments which aim to measure SDLR. Congruent with the PRISMA-P, the systematic review has been registered with PROSPERO, and a detailed protocol developed prior to implementation of the systematic review. Since no systematic review had evaluated psychometric properties of instruments measuring SDLR, development of a targeted protocol was required.

3.2.3 Cross-sectional studies

A cross-sectional study gathers data from a population, or sample of a population, at one specific point in time (Cohen, Manion, & Morrison, 2011). Cross-sectional studies are often used when the purpose of the study is descriptive. They can also be useful when investigating associations between variables and an outcome of interest, however, as measurement occurs at only one point in time, cross-sectional studies should not be used to determine causal or temporal relationships (Levin, 2006). One of the advantages of cross-sectional studies, is that there is no loss to follow-up as data collection occurs only at one point in time. There is, however, potential for the study to be influenced by low response rates, or when the sample is not representative of the population (Austin, Hynes, & Miller, 1999). Researchers need to be cognizant of these issues when recruiting participants and in the interpretation of results. In the PhD study series, a cross-sectional design was used to investigate SDLR of students in first year, first semester of health professional programs. The study investigated the association between student SDLR and demographic, personality and educational factors.

3.2.4 Cohort studies

Cohort studies collect information about individuals, and follow these same individuals over a period of time, either prospectively or retrospectively (Cohen et al., 2011). Unlike cross-sectional studies, cohort studies are longitudinal, and provide the potential to investigate changes over time in variables of interest. Care must, therefore, be taken to ensure variables are measured consistently across times points (Sedgwick, 2013). As measurement occurs at several

points in time, however, cohort studies are subject to participant attrition over time. The number of participants lost in follow up can have an impact on the internal validity of the study (Song & Chung, 2010). Researchers need to employ strategies to maximise participant retention in the study, and examine differences between those who remain in the study and those lost to attrition (Song & Chung, 2010).

Two cohort studies were included in the PhD study series:

- i) investigation of the influence of student SDLR, and personality, demographic, and education factors (measured early in the semester) on results in an interprofessional unit (end of semester grades).
- ii) investigation of changes in student SDLR from first year to third year (same cohort of students), and identification of the factors which influenced change in SDLR.

3.2.5 Overarching design and method

Detailed description of the methodology used for the scoping review and systematic review are presented in *Chapters 4* and *5* respectively. The overarching design and method for the observational studies are presented below.

3.3 Participants

Participants in the studies were students in undergraduate health professional programs at Western Sydney University. Western Sydney University is a large, comprehensive metropolitan university with six campuses across Greater Western Sydney which is Australia's fastest growing, most culturally and linguistically diverse region encompassing some of the poorest socio-economic communities in Sydney. The majority of students in the university in all disciplines including health science are 'first in family' to attend university. The study population were students in the following health professional programs in the School of Science and Health:

- Bachelor of Health Science:
 - i. Majors in Health Promotion, Health Services Management or Therapeutic Recreation* (health sciences)
 - ii. Major in Sports and Exercise Sciences* (sports and exercise sciences)
- Bachelor of Health Science/Master of Occupational Therapy (occupational therapy)
- Bachelor of Health Science/Master of Physiotherapy (physiotherapy)
- Bachelor of Health Science/Master of Podiatric Medicine (podiatry)

Occupational therapy, physiotherapy and podiatry were double-degree, undergraduate programs undertaken over four years leading an entry-level qualification for professional practice in the respective discipline. Students had the option of exiting at the end of the third year with a Bachelor of Health Science if they chose not to complete the program. Students who exited at this point were not eligible to apply for professional registration with AHPRA, or membership with the occupational therapy, physiotherapy or podiatry professional societies in Australia.

The cohort investigated commenced their program in 2010. On entry, there were 584 students enrolled across all five programs (158 health sciences, 215 sports and exercise sciences, 86 occupational therapy, 71 physiotherapy, and 54 podiatry students).

3.4 Data collection

A self-report survey was administered in first year, first semester (2010). This dataset was used in the cross-sectional and cohort studies. Additional data were collected to answer the longitudinal study questions, and a second survey was administered to the same cohort, in third year, second semester of 2012. Follow up data were thus close to a 3-year academic enrolment time. Collection at this time point was critical as health science and sports and exercise were 3-year degree programs therefore, most students were in their final semester before graduating. The data collected in 2010 were matched to data in 2012 using student identification codes for use in the longitudinal study.

3.4.1 Recruitment and survey administration

First year

All students undertook an introductory interprofessional education unit, called *400871 – Professional Health Competencies*, in first year, first semester. The unit was delivered for the first time in 2010, and as such, students were required to complete a series of surveys to inform quality improvement and evaluate teaching approaches used in the unit. The Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) and the ‘Big Five’ Personality Trait Inventory (‘Big Five’) (Goldberg, 1992) were included. Students completed the surveys online on the university e-learning platform in their own personal time, away from the researchers. The entry page for the first-year survey is shown in *Appendix C*.

Third year

In 2012, students in the same cohort were invited via email to participate in a follow-up survey which included the SDLRS. The introductory email (*Appendix A*) and attached participant information sheet (*Appendix B*) included information about the purpose of the study, the participant’s involvement, confidentiality, benefits of participation, Human Research Ethics Committee (HREC) approval numbers and details on how to participate in the study. Students were able to voluntarily participate in the study by completing the survey online via SurveyMonkey.com or in paper format. The survey was open for eight weeks from the date the introductory email was sent. The entry page for the third-year survey is shown in *Appendix D*.

3.4.2 Student admission and academic data

Collection of student admission and academic data was approved by the Western Sydney University Human Research Ethics Committee [H9857], and the University of Wollongong/Illawarra Shoalhaven Local Health District Human Research Ethics Committee [HE12/226] (further details will be presented in section 3.7). Student admission and academic data was obtained from the Western Sydney University Office of Strategy and Quality in 2012.

The student data was accessed by examining the enrolment records of each student enrolled in 400871 – Professional Health Competencies in 2010. The following information was obtained:

- Gender
- Date of Birth
- Program
- Highest level of education on admission
- Grade and mark for completed units
- Grade point average (GPA) as at July 2012
(end of first semester in students' third year of study)

3.4.3 Contextual framework

Astin's (1993) I-E-O model was used as a conceptual framework for the PhD study series. The variables investigated in the PhD study series are presented in *Figure 3.2* with application to the I-E-O model.

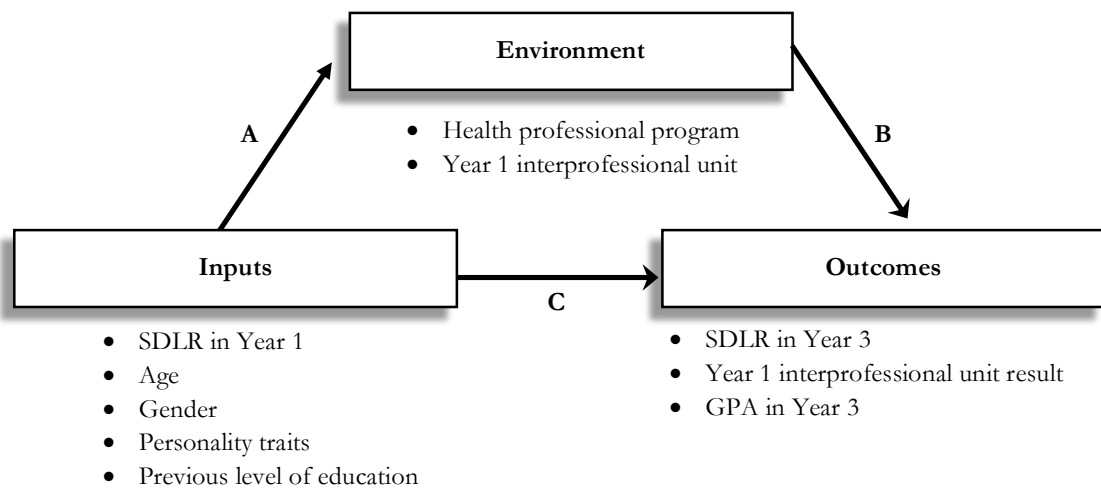


Figure 3.2 Variables investigated in the PhD series with application to the I-E-O model

Adapted from *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education* (2 ed.) (p. 28) by A.W. Astin, 2012, Lanham, MD: Rowman & Littlefield Publishers. Copyright by Rowman & Littlefield Publishers. Reproduced with permission.

In the study series, SDLR in first year and third year was measured using the SDLRS (Guglielmino, 1978). As this study investigated changes in students' attitudes and preparedness for self-directed, lifelong learning over time, SDLR was both an input and an outcome. How students implemented SDL was not investigated in this study.

Personality traits were measured using the 'Big Five' (Goldberg, 1992) and results in the first year interprofessional unit were a mark out of 100. A description of the first year interprofessional unit (400871 – Professional Health Competencies) is presented in *Appendix E*. An overview of the curriculum in each of the five health professional programs is also presented in the appendices: *Appendix F* shows the common units undertaken by two or more programs and *Appendix G* shows the discipline-specific units undertaken in each program.

3.5 Instruments

3.5.1 Self-Directed Learning Readiness Scale

3.5.1.1 Description

The SDLRS (Guglielmino, 1978) is a self-report questionnaire which was designed to measure “the complex of attitudes, abilities, and characteristics that comprise readiness to engage in self-directed learning” (Guglielmino and Associates, n.d, para. 2). The SDLRS is the most widely used instrument measuring SDLR (Merriam, Caffarella, & Baumgartner, 2007). While the instrument was first developed in English, it has now been translated in over twenty other languages (Guglielmino and Associates, n.d).

There are three versions of the SDLRS:

- 1) SDLRS-A for the general adult population
- 2) SDLRS-ABE for adults with low reading levels or non-native English speakers
- 3) SDLRS-E for elementary children.

The SDLRS-A version was used in this study. The instrument is also known as the Learning Preference Assessment. As a means to reduce response bias, Guglielmino and Associates (n.d) suggest the title 'Learning Preference Assessment' should be used when administered. The term SDLRS will be used throughout the thesis when referring to the SDLRS-A instrument. The SDLRS is copyright and must be purchased. Sufficient surveys were purchased for this study. Further details about the SDLRS is presented in *Appendix H*.

The SDLRS has 58 items which are scored from one to five, as follows:

- 1 = Almost never true of me; I hardly ever feel this way.
- 2 = Not often true of me; I feel this way less than half the time.
- 3 = Sometimes true of me; I feel this way about half the time.
- 4 = Usually true of me; I feel this way more than half the time.
- 5 = Almost always true of me; there are very few times when I don't feel this way

For each item, respondents select the response which best reflects their attitude or preferences to learning. Scores range from 58 through 290. Guglielmino and Associates (n.d) report the mean in an adult population is 214 ± 25.6 , and present the following ranges to guide interpretation of results:

58 – 201	Below average
202 – 226	Average
227 – 290	Above average

3.5.1.2 Development

The SDLRS was developed by Lucy Guglielmino for her doctoral dissertation. Guglielmino (1978) used Delphi technique to develop the content for the SDLRS. Fourteen experts in adult education were involved in the Delphi survey, including three authorities on SDL: Malcolm Knowles, Cyril Houle, and Allen Tough (Guglielmino, 1978). Through three rounds of Delphi survey, characteristics important for self-directed learning were derived. These formed the basis

for construction of the SDLRS items. Following initial development of the items, the instrument was administered to a pilot group of 307 subjects, which resulted in some revision of the items.

Guglielmino (1978) performed a principal component analysis of the SDLR which found eight factors:

- 1) Openness to learning opportunities
- 2) Self-concept as an effective learner
- 3) Initiative and independence in learning
- 4) Informed acceptance of responsibility for one's own learning
- 5) Love of learning
- 6) Creativity
- 7) Positive orientation to the future
- 8) Ability to use basic study and problem-solving skills.

While the SDLRS measures SDLR across these eight factors, Guglielmino reports these factors should not be used as sub-scales, only the total score should be used.

3.5.1.3 Psychometric properties

Guglielmino and Guglielmino (1991) reported the SDLRS to have a split-half reliability of $r = 0.94$. Test-retest reliability has also been reported as $r = 0.79$ (Wiley, 1983) and $r = 0.82$ (Finestone 1984). Construct validity of the instrument, however, has been a point of debate in the literature, with both criticism (Bonham, 1991; Brockett, 1985; Hoban, Lawson, Mazmanian, Best, & Seibel, 2005) and support (Delahaye & Smith, 1995; Finestone, 1984; Torrance & Mourad, 1978). Delahaye and Choy's (2000) examination of the validity and reliability of the SDLRS concluded that there was extensive evidence in the literature that it is an accurate and useful instrument for measuring SDLR.

Exploration of the psychometric properties of instruments measuring SDLR (including the SDLRS) will be conducted in a systematic review of literature involving students in pre-certification health professional programs. Details of the systematic review are presented in *Chapter 5*.

While there has been support for the SDLRS in the literature, the instruments has also received some criticism. Field (1989) reported concerns with the development of the SDLRS, which he argued had implications on instrument's reliability and validity. Field questioned whether Delphi survey was an appropriate approach to form the basis for item generation. Field also was concerned that the terms 'readiness' and 'self-directed learner' were not defined in Guglielmino's (1978) study. Other concerns included the use of negatively phrased items in the instrument, and the inclusion of additional items after the validation study. Field then presented the results of an investigation of psychometric properties, including a factor analysis. His conclusion was that the findings did not support continued use of the SDLRS.

In response, Guglielmino (1989) presented a rebuttal to Field's concerns. Guglielmino clarified that Delphi technique was not employed to select items, as Field had indicated, but rather in arriving at a consensus on the characteristics of SDL. It was also argued that the Delphi panel would be able to draw on their experience with self-directed learners, rather than the process being an introspective means of determining key characteristics, as Field had argued. Guglielmino then stated that while she did not define 'self-directed learning', the term was defined by the Delphi panel. This was a deliberate approach to ensure construct validity of the scale, and was argued to be more preferable than having one individual's definition. As for the term 'readiness', Gugliemino accepted that this should have been defined, however, she asserted that readiness was a continuum, contrary to Fields position that learners were either ready or not ready. Guglielmino also defended her use of reverse questions, indicating that this was common in instruments to reduce the likelihood that participants would select the same responses without careful reading of the items. She also presented additional data which supported item-

test correlation. Lastly, Guglielmino corrected Field's understanding that items were included after validation. While items were included after the initial pilot study, there were no changes to the instrument following the validation study. Long (1989) and McCune (1989) also defended use of the instrument, citing omissions in Field's literature review of studies supporting validity of the instrument, as well as several issues with the methodology and statistical analyses used in his study.

3.5.1.4 *Alternative instruments*

Several instruments have been used to measure SDLR of students in health professional programs. Slater and Cusick (2017) (this study presented in full in *Chapter 4* of this thesis) found that most have used the Self-Directed Learning Scale for Nursing Education (SDLSNE) (Fisher, King, & Tague, 2001) or the SDLRS. The Competencies of SDL (Knowles, 1975), Oddi's Continuing Learning Inventory (Oddi, 1986), Ryans' two-part questionnaire (Ryan, 1993), and the Self-Directed Learning Inventory (Cheng, Kuo, Lin, & Lee-Hsieh, 2010) have also been used, however, only in very few studies.

By way of comparison to the SDLRS, the SDLSNE (Fisher et al., 2001) is a self-report 40 item questionnaire with three sub-scales: self-management, desire for learning, and self-control. For each item, respondents select the response which best reflects their own characteristics using a five point Likert scale where 1 = strongly disagree, and 5 = strongly agree. Similar to the SDLR, the SDLSNE was developed using Delphi technique, however this involved eleven nurse academics and nurse educators. Several studies have supported the SDLSNE's internal reliability (Fisher et al., 2001; Phillips, Turnbull, & He, 2015; Smedley, 2007), however further investigation of the instrument's construct validity has been recommended (Fisher & King, 2010; Williams & Brown, 2013).

3.5.1.5 Rationale for use

The SDLRS was selected for use in the current study in light of its extensive use in higher education, specifically with students in health professional programs. The current study did not include nursing students, so use of the SDLRSNE was less preferable. While use of the SDLRSNE has extended to medicine and pharmacy, comparative studies in occupational therapy and physiotherapy have all used the SDLRS (Kell, 2006; Kell & van Deursen, 2000, 2002, 2003; Kell, 2007; Linares, 1999; Malta, Dimeo, & Carey, 2010). Given the SDLRSNE was developed for use with nursing student cohorts, use of the instrument would first require validation in an allied health student population. This was seen to be unnecessary and beyond the scope of this research when comparative studies in allied health programs were available, all using the SDLRS.

3.5.2 ‘Big Five’ Factor Personality Trait Inventory

3.5.2.1 Description

The ‘Big Five’ personality trait inventory (Goldberg, 1992) is available from the International Personality Item Pool (IPIP) (Goldberg, 1999). The inventory is a self-report questionnaire which measures personality on five domains: ‘extraversion’, ‘agreeableness’, ‘conscientiousness’, ‘emotional stability’, ‘intellect/imagination’. The ‘Big Five’ is one of many instruments which measure personality across five factors or dimensions. This is often referred to as the Five Factor Model.

There are two versions of the ‘Big Five’, a 50 item and a 100 item. The 50-item version was used in the current study to minimize survey fatigue since a number of other surveys were being administered to the multidisciplinary first year cohort. The 50-item version of the ‘Big Five’ has ten items for each of the five personality domains. There are mixed positively and negatively keyed items in each domain. For each item, participants select one of the five responses: disagree, slightly disagree, neutral, slightly agree, or agree. Scores for each domain are totaled,

with respect to whether items are positively or negatively keyed. For positively keyed items, Disagree = 1 through to Agree = 5. For negatively keyed items, Disagree = 5 through to Agree = 1. For each domain, scores range between 10 and 50. The 'Big Five' is available in the public domain on the IPIP website (<http://ipip.ori.org/>) which indicates that scales can be used freely without requiring permission or payment. A full version of the 'Big Five' is presented in *Appendix I*.

3.5.2.2 Development

The 'Big Five' personality traits were derived from a lexical research approach. The underlying tenet for using this approach was that most salient personality traits have been captured in language and expression (John & Srivastava, 1999). Early work by Allport and Odbert (1936) derived a list of nearly 18,000 personality-related terms from the English dictionary. Further work by Cattrell was done to reduce the number of terms in the list (Cattell, 1943), and conduct factor analyses (Cattell, 1945). The five factors were first identified by Tupes and Christal (1962) and labelled by Norman (1963). Goldberg (1981) was the first to refer to these five factors as the 'Big Five' personality traits.

Extending from Cattrell's previous work, Costa and McCrae developed the NEO Personality Inventory (Costa & McCrae, 1985), later revised to the NEO PI-R (Costa & McCrae, 1992) which measured the five personality domains: 'extraversion', 'agreeableness', 'conscientiousness', 'neuroticism' and 'openness to experience'. Concurrent work by Goldberg (1992) led to the development of markers for the 'Big Five' factor structure: 'extraversion', 'agreeableness', 'conscientiousness', 'emotional stability', and 'intellect/imagination'. The 'Big Five' markers and the NEO PI-R are extremely similar, however there is a difference in the fifth factor, which in the NEO PI-R is 'openness to experience' and in the 'Big Five' is 'intellect/imagination'. Another difference is that the original versions had different numbers of items - the NEO PI-R had 240 and the 'Big Five' had 100 items. Despite this, there does not appear to be an apparent benefit in using one measure over the other.

Since the development of these two instruments, there has been a proliferation of scales and items related to the five personality domains. Goldberg (1999) developed the IPIP website as a means to list, develop and refine these personality inventories in the public domain. The measure used in this study is the IPIP representation of the Goldberg (1992) 'Big Five' markers.

3.5.2.3 Psychometric Properties

Goldberg (1992) found preliminary evidence of construct validity of the 'Big Five' with the NEO PI-R and Hogan's Personality Inventory (Hogan, 1986). Further work by Gow, Whiteman, Pattie, and Deary (2005) found concurrent validity in each of the domains with the NEO FFI (a 60-item version of the NEO PI-R) (Costa & McCrae, 1992) and the Eysenck Personality Questionnaire-Revised Short Form (Eysenck, Eysenck, & Barrett, 1985). In a study comparison with the NEO FFI, Lim and Ployhart (2006) found support for convergent and discriminant validity of the 'Big Five'. The study also supported the instruments construct validity.

As per the IPIP website, the 'Big Five' has internal consistencies ranging $\alpha = 0.79$ to $\alpha = 0.87$ across the five factors with a mean of $\alpha = 0.84$. The average correlation with factor markers was $r = 0.67$. In a study of university students in Scotland, Gow et al. (2005) found internal consistencies ranging $\alpha = 0.72$ to $\alpha = 0.87$, and also confirmed the five-factor structure.

3.5.2.4 Rationale for use

The 'Big Five' was selected for use in the current study given its wide use in educational research and its psychometric properties. The instrument measures the strength of personality traits across a continuum, rather than categorizing participants into personality types, such as the Myers-Briggs Type Indicator (MBTI) (Myers, McCaulley, & Most, 1985). This was seen to be more useful in the analysis of student data to better understand the relationships between personality trait, SDLR and academic performance. Given the 'Big Five' and the NEO PI-R are

extremely similar, the ‘Big Five’ was selected as it has been used in the literature to investigate personality traits of medical students (Ferguson, Sanders, O’Hehir, & James, 2000; McManus, Keeling, & Paice, 2004).

3.6 Data analysis

Data were entered in to the Statistical Package for the Social Sciences® (SPSS) version 22.0 (IBM Corp., Armonk, NY, USA) for analysis. A description of data analysis methods for each observational study is presented in *Chapters 6, 7, and 8*.

3.7 Research ethics

3.7.1 Ethical approval

Ethical approval was obtained from the University of Wollongong/Illawarra Shoalhaven Local Health District (ISLHD) Human Research Ethics Committee (HREC) [HE12/226] and the Western Sydney University HREC [H9857] in September 2012. Approval from both HRECs was necessary as the PhD candidature was at the University of Wollongong, and the study site was the Western Sydney University. The process involved obtaining conditional approval from the University of Wollongong/ISLHD HREC (*Appendix J*), reciprocal approval from the Western Sydney University HREC (*Appendix K*), and then final approval from the University of Wollongong/ISLHD (*Appendix L*) as the lead HREC.

The research project was initially designed to investigate the learning profiles and experiences of students from non-traditional backgrounds in health professional programs. To do this, it was intended that a subset of the sample data would be examined (male, mature, and culturally diverse) however, by the time data had been collected the university had shifted from a policy and pedagogy focus on identification of ‘exceptional’ groups with specialized support strategies to one where whole student cohorts should be better understood with regard to key graduate

outcomes such as lifelong learning and SDL. For this reason, the PhD research questions were refined and nature of data analysis shifted from a subset to focus on the SDLR of students in health professional programs across the whole cohort. As data collection had already occurred, there were no changes to recruitment or storage of the data. A request to change the project title and shift the focus of data analysis was communicated in the PhD candidate's annual progress report to both the University of Wollongong/ISLHD HREC (*Appendix M*) and the Western Sydney University HREC (*Appendix N*). Approval for the changes was received from both HRECs (*Appendices O & P*). No new ethics application was required. There were no changes to the dissemination of results - only grouped data would be presented and no individual participants would be identifiable. Throughout the duration of the research project, the approved protocol and researcher responsibilities were upheld.

3.7.2 Informed consent and voluntary participation

In 2010, students completed the SDLRS and the 'Big Five'. At the commencement of the survey (*Appendix C*), students were asked:

- i) Can we add your de-identified/anonymous results to other surveys to make a group summary? Yes / No
- ii) Can we use your de-identified/anonymous results in teaching other health science students? Yes / No
- iii) Can we use your de-identified/anonymous results in any other future research about health science students? Yes / No

The University of Wollongong/ISLHD HREC and Western Sydney University HREC provided retrospective approval to use survey data from students who indicated that their results could be used in future research.

In 2012, the same cohort of students was invited to complete a follow-up survey which included the SDLRS. The invitation to participate was sent as an email (*Appendix A*) with summary

information about the study, together with a participant information sheet (*Appendix B*). Participation in the study was voluntary and students could withdraw at any time without giving reason and without consequences. Students were advised that participation, non-participation or withdrawn participation would not affect their grade in any unit, their relationship with the teaching staff at Western Sydney University or the University of Wollongong, their colleagues, or the governing institutions. As students were free to ignore the invitations, accessing and completing the survey indicated tacit consent.

3.7.3 Incentives

While web-based surveys are an efficient way of administering surveys, maximizing participation can be a challenge. Incentives for participation have long been used in research as a means to increase response rates. In a series of four studies, Laguilles, Williams, and Saunders (2011) found that lottery incentives can be effective in increasing participation in web-based surveys in an undergraduate university student population. In the current study, given participation in the 2012 survey was voluntary, and that students would unlikely have a strong interest in the topic, a lottery incentive was offered to enhance participation. Use of a lottery incentive was approved by both the University of Wollongong/ISLHD and the Western Sydney University HRECs. All students who completed the study were eligible to win one of five \$100 JB HiFi (electronics retailer) or \$100 Coles (supermarket retailer) gift cards. Once the survey closed, student ID numbers of participants were printed, cut up individually, and placed into a pool. A research assistant from the University of Wollongong who had no association with Western Sydney University selected five student numbers at random, much like a ‘drawn from a hat’ type draw. The winners were notified by email and were able to select either the JB Hi-Fi or Coles gift card. Details of the incentives and process to select winners was described in the participant information sheet.

3.7.4 Confidentiality and anonymity

Student survey, admissions and academic data were held confidentially and were only accessible to the PhD candidate, primary supervisor, associate supervisor and research assistant. In the analysis and dissemination of results, only grouped data will be presented and no individual participants will be identifiable.

Students were asked to enter their student ID numbers on both surveys to enable matching of 2010, 2012, admissions and academic data for data analysis. To ensure student participation and student data remained anonymous to the PhD candidate and supervisors, a research assistant from the University of Wollongong completed the following tasks:

- i) data entry of the 2012 paper surveys into the online survey on SurveyMonkey.com
- ii) matching of 2010, 2012, admissions and academic data by student ID number to create a master dataset
- iii) de-identification the master dataset by removing student ID numbers

The PhD candidate and supervisors were then given access to the de-identified master dataset for analysis.

3.7.5 Data management

Survey data from 2010 was collected through the university e-learning platform and data files are electronic. In 2012, students were able to complete the survey either online via SurveyMonkey.com, or in paper format. Surveys completed in paper format were then entered into SurveyMonkey.com by a research assistant, and the combined dataset extracted into an electronic MS Excel™ file. All survey, admissions and academic electronic files in MS Excel™ were imported into version 22.0 of SPSS®. Data analysis of the master dataset occurred in SPSS®. Throughout the duration of the project, electronic data has been stored in password protected electronic files, and the paper surveys stored in a locked file in a locked office.

3.8 Chapter synopsis

Two literature review studies and three observational studies were conducted to investigate SDLR of students in health professional programs. For the observational studies, undergraduate students in health sciences, sport and exercise science, occupational therapy, physiotherapy and podiatry programs completed the SDLRS (Guglielmino, 1978) and the 'Big Five' personality trait inventory (Goldberg, 1992) as non-assessable learning activities in first year, first semester. The same cohort of students was invited via email and campus flyers to complete the SDLRS again in third year, second semester. Survey data was collected online, using SurveyMonkey.com, or paper surveys which were later entered into an electronic file. Student demographic and academic data were obtained from the university. First year and third year survey data, and student demographic and academic data were matched together using student ID numbers. Data analysis occurred using SPSS® version 22.0. The study protocol was approved by the University of Wollongong/ISLHD and the Western Sydney University HRECs.

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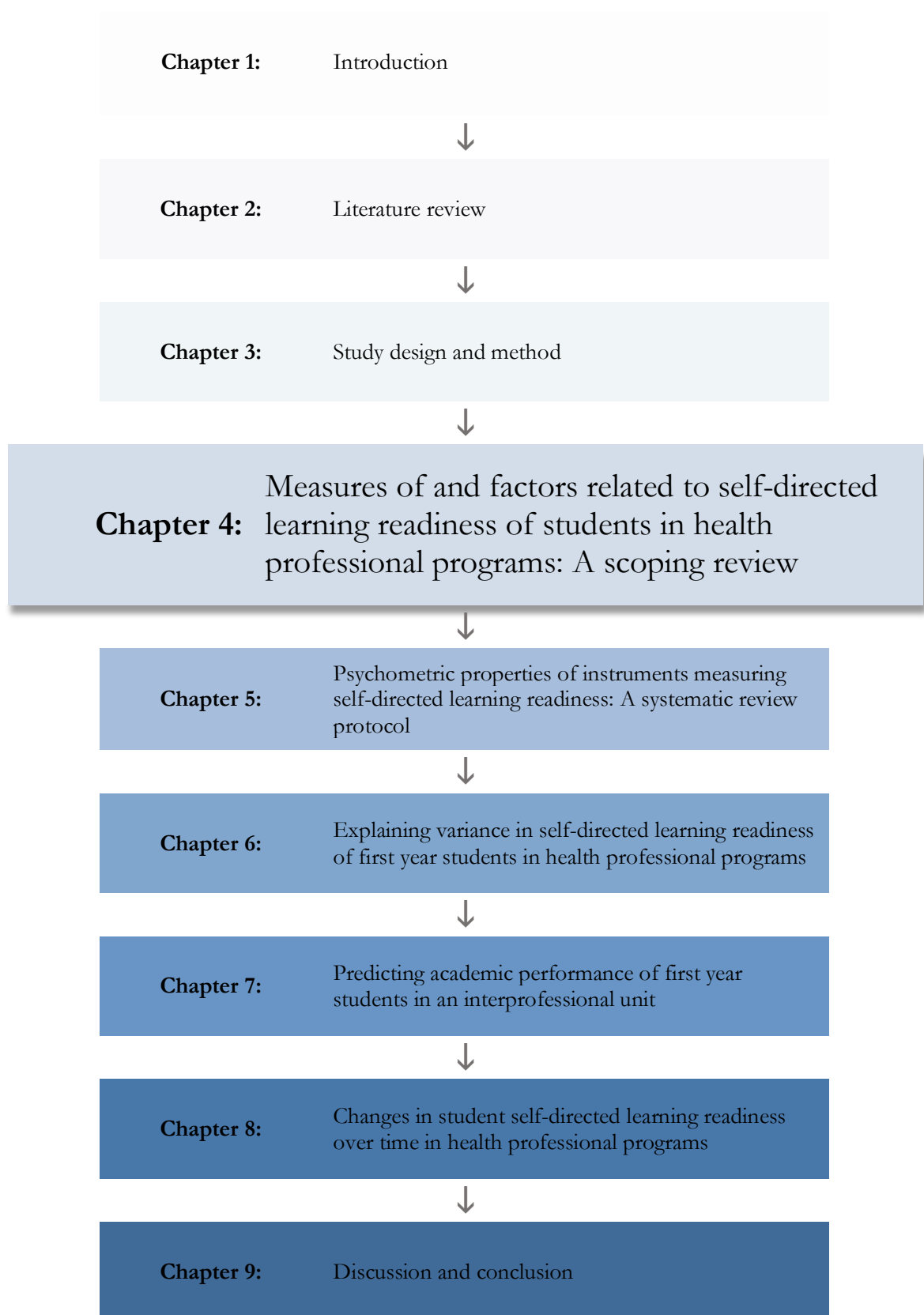


Figure 4.1 Thesis chapter progression: Chapter 4

Chapter 4

Measures of and factors related to self-directed learning readiness of students in health professional programs: A scoping review

This chapter is the pre-print version of a paper published in the peer reviewed journal, *Nurse Education Today*. The letter of acceptance for publication in the journal is shown in *Appendix Q*.

Slater, C.E. and Cusick, A. (2017) Factors related to self-directed learning readiness of students in health professional programs: A scoping review. *Nurse Education Today*, 52, 28-33. doi: [10.1016/j.nedt.2017.02.011](https://doi.org/10.1016/j.nedt.2017.02.011)

Link to publication: <http://www.sciencedirect.com/science/article/pii/S0260691717300345>

Journal author guidelines: <http://www.nurseeducationtoday.com/content/authorinfo>

Author Declaration: The manuscript draft was prepared by the candidate (CS) with supervision of Professor Anne Cusick (AC) as specified in the author contributions statement below.

Author Contribution statement:

CS completed this paper as a component of a PhD study series supervised by AC. CS and AC collaborated in the design of the study. CS was lead investigator for search implementation, reviewing all retrieved papers contained in this scoping review, extracting information, tabling data, first draft of interpretation, drafting of the first full version of the original submitted paper and revised versions following *Nurse Education Today* reviewer feedback.

AC reviewed the search strategy and papers retrieved, was second independent rater, assessing each item against inclusion criteria and verifying results output and the summary presented in the paper. AC contributed to iterative versions of the original paper submitted to *Nurse Education Today* through supervisory discussion, feedback and review, and she confirmed the revisions made by CS in response to *Nurse Education Today* reviewer feedback.

This chapter (author statement and preamble) was authored by CS under supervision feedback of AC, with the pre-print version of the published paper inserted after the preamble. Referencing, heading numbers, figure numbers and table numbers differ from the published paper in order to maintain formatting consistency throughout the PhD thesis.

4.1 Preamble

This chapter presents a scoping review exploring measures of SDLR and the factors which have been investigated in the health disciplines for potential association with SDLR. This study addresses *Research Objective 1: to determine the factors which influence SDLR of students in health professional programs*. It also identifies the instruments used in each of the studies, and therefore, also addresses (in part) *Research Objective 2: to explore the attributes of instruments used to measure SDLR of student in health professional programs*. While SDLR has received wide attention in the health disciplines, no other study has attempted to identify all the factors investigated in the literature and synthesize the findings. The scoping review fills this gap. The findings from this study also informed the selection of the factors investigated and the measure used in the studies presented in subsequent chapters of this thesis. Of the five most commonly investigated factors found in this study (*Chapter 2*), four were included in *Chapters 6, 7 and 8*. The only factor which was not included in these subsequent studies was ‘program delivery’ as there were no differences in modes of delivery between the included disciplines. The SDLR measure used in these subsequent chapters was the SDLRS (Guglielmino, 1978), which was found in this study (*Chapter 2*) to be the most commonly used measure in the health disciplines.

4.2 Abstract

Background: Academic and professional drivers have stimulated interest in self-directed learning of students in pre-certification health professional programs. Particular attention has focussed on factors which may influence a students' readiness for self-directed learning.

Method: A five-stage structured scoping review of published literature was conducted to identify measures of self-directed learning readiness used with students in pre-certification health professional programs and those factors that have been investigated as potential determinants. Relevant articles were identified in six databases using key search terms and a search strategy. Two independent reviewers used criteria to cull irrelevant sources. Articles which met eligibility criteria were charted.

Results: The final analysis included 49 articles conducted in nursing, medicine, physiotherapy, pharmacy, occupational therapy and dentistry cohorts. Twenty-one potential determinants had been investigated with gender, year level, age program delivery and previous education level the most common. Self-directed learning readiness has been of interest globally, mostly in medicine and nursing, and studies have nearly exclusively used one of two instruments.

Conclusion: There is nascent evidence that age, year level and previous education level may have positive influence. These factors have in common the passing of time and may in fact be proxy for more encompassing developmental or social constructs. Further research is needed particularly in the allied health professions where there is limited research in very few disciplines. Studies in interprofessional contexts may be an efficient approach to increasing the knowledge base. Further work is also warranted to determine appropriate use of the two instruments across the range of health disciplines.

Keywords: education, professional; interdisciplinary studies; students, health occupations

4.3 Introduction

Pre-certification health professional programs commonly adopt adult learning approaches, differing from the pedagogical models of teaching and learning used in secondary (high school) education. One key premise of adult learning models is that learners are self-directed in their approach to learning (Knowles, 1975). Knowles defines this self-directed learning as “a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes” (Knowles, 1975, p. 18).

Professional behaviours such as reflective, evidence-based and life-long learning practices to maintain knowledge currency assume that graduates entering the workforce already have the ability to direct their own learning. In consequence, the readiness of students, graduates and experienced practitioners for self-directed learning has been the subject of research enquiry. Wiley identified this as the degree to which an individual possesses “the attitudes, abilities and personality characteristics for self-directed learning” (Wiley, 1983a, p. 182). While some studies (Chiang, Leung, Chui, Leung, & Mak, 2013; Lunyk-Child et al., 2001; Premkumar et al., 2013; Pryce-Miller, 2010) have explored students’ self-directed learning readiness through qualitative or mixed method approaches, most have adopted quantitative approaches using standardized instruments.

The Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) was the first instrument to measure self-directed learning readiness. More recently, several other instruments have been developed: Oddi's Continuing Learning Inventory (OCLI) (Oddi, 1986); Ryan's two part self-assessment questionnaire (Ryan, 1993); the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher, King, & Tague, 2001) and the Self-Directed Learning Instrument (SDLI) (Cheng, Kuo, Lin, & Lee-Hsieh, 2010). Although developed as a learning

resource, the self-report Competencies of Self-Directed Learning (Knowles, 1975) has more recently been used as a measure.

To date no study has examined the literature to identify what is known about measures of self-directed learning readiness or factors that have been investigated as potentially associated with it. This study aims to map previous research using quantitative methods to identify the standardised measures used to investigate readiness for self-directed learning and factors investigated as potentially or actually associated with it. The study is restricted to research investigating students in pre-certification health professional programs.

4.4 Method

A scoping review design was adopted to collect, summarise and chart the existing literature on the topic of self-directed learning readiness of students in pre-certification health professional programs. The Arksey and O'Malley (2005) five-stage framework was used: (1) formulating the question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing and reporting the results. In addition, the design was refined using Levac, Colquhoun and O'Brien's (2010) recommendations on the Arksey and O'Malley framework; specifically the process for study selection and the process for collating, summarizing and reporting the results. Scoping reviews allow for broad exploration of an issue and will often report on the "volume, nature and characteristics of the primary research" (Arksey & O'Malley, 2005, p. 30). This differs from a systematic review which focuses on a specific question and typically assesses the quality of the studies included.

4.4.1 Stage 1: formulating the question

The focus of this scoping review was to explore the self-directed learning readiness of students in pre-certification health professional programs and factors proposed to affect it. The research question which guided the study was 'What factors have been investigated in studies examining self-directed learning readiness of students in pre-certification health professional programs?'.

For the purposes of this study, *health professional* disciplines included medicine, nursing, midwifery, dentistry and allied health professions.

In the absence of a definitive agreement, nationally or internationally, as to which professions are considered allied health professions, the researchers used the Australian Health Workforce Advisory Committee (2006) definition which includes the following 12 professions: audiology, dietetics and nutrition, occupational therapy, orthoptics, orthotics and prosthetics, pharmacy, physiotherapy, podiatry, psychology, radiography, speech pathology and social work.

4.4.2 Stage 2: identifying relevant studies

Key search terms and a search strategy were developed to investigate the research question, and were reviewed by a librarian to increase rigor. The search terms, presented in *Table 4.1*, were used in the following databases: CINAHL, PsychINFO, MEDLINE, ERIC, Scopus, and Web of Science. The review was limited to journal articles written in English. Grey literature was excluded from this scoping review. The search retrieved 351 articles across the six databases, which was reduced to 199 once duplicates were removed. Articles not published in English and not published in peer reviewed journals were also removed, reducing the number of articles to 118.

Discipline	Students	Self-directed learning readiness
(medical OR medicine OR nursing OR midwifery	(undergraduate	(self-directed
OR dental OR dentistry OR allied health OR health	OR graduate OR	learning readiness
science* OR audiology OR dietetic* OR nutrition*	university OR	OR self directed
OR occupational therapy OR orthoptic* OR	student*) AND	learning readiness)
orthotic* OR prosthetic* OR pharmacy OR		
physiotherapy OR physical therapy OR podiatr* OR		
chiroprody OR psychology OR radiography OR		
speech pathology OR speech therapy OR speech		
and language therapy OR social work) AND		

Table 4.1 List of search terms used

4.4.3 Stage 3: study selection

The selection process is shown in *Figure 4.2*, using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) flowchart (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009). The authors independently reviewed abstracts of the 118 articles identified in the database search against the following inclusion criteria, decided *a priori*:

- 1) studies which included students in one or more of the health disciplines defined above
- 2) studies including students in pre-certification programs (either undergraduate or graduate entry programs)
- 3) studies where self-directed learning readiness was a primary outcome variable
- 4) quantitative studies using a standardized instrument to measure self-directed learning readiness

Studies where the primary purpose was to explore psychometric properties of self-directed learning measures were excluded from this scoping review.

The authors independently screened 118 articles and then reviewed full-text versions of 60 articles to confirm eligibility for inclusion. The authors met to discuss one study where there was rater disagreement. The full text was re-read and a consensus agreement reached. At the end of the selection process, 49 studies met inclusion criteria.

4.4.4 Stage 4: charting the data

A table reporting the author, year, disciplines, instrument used and sample size of each study is included (Supplementary material). This table charts the factors investigated and any significant results in the included articles. To assist in study comparison, factors were grouped into: demographic, educational, program, academic and professional factors.

4.4.5 Stage 5: collating, summarizing and reporting the results

A summary of study characteristics is presented in *Table 4.2*, an analysis of instruments used by discipline is presented in *Table 4.3* and a summary of the factors investigated is presented in *Table 4.4*. Interpretation of the findings is presented the discussion section of this scoping review.

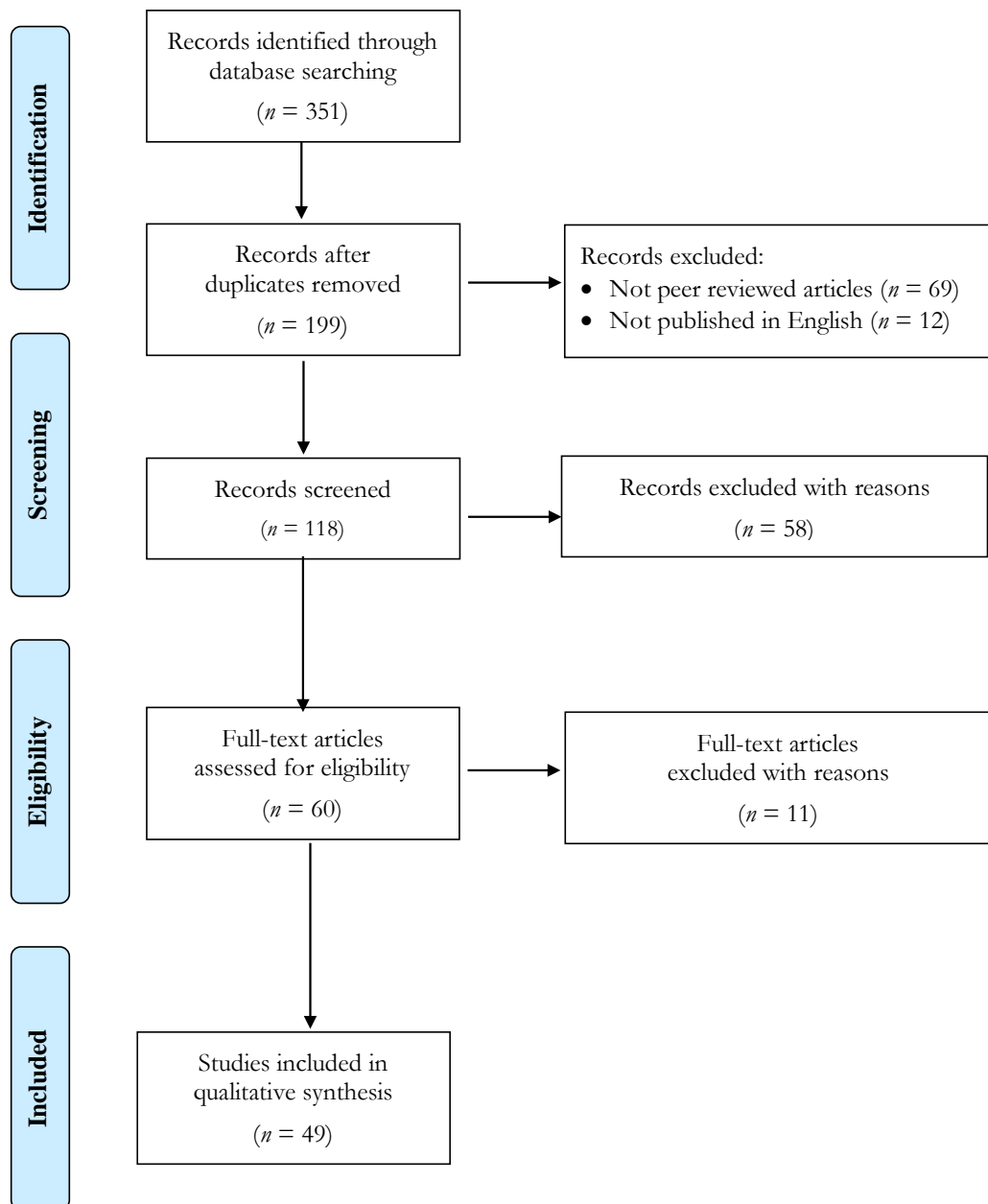


Figure 4.2 PRISMA flowchart of selection process

From “Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement” by D. Moher, A. Liberati, J. Tetzlaff, D.G. Altman, The PRISMA Group, 2009, *PLoS Med*, 6, p. e1000097. Reproduced in accordance with the Creative Commons Attribution (CC BY) license.

4.5 Results

Characteristics of included studies are reported in *Table 4.2*. The 49 included studies were conducted across 15 countries; most in the United States of America (20.4%), Canada (12.2%) and the United Kingdom (12.2%). Students in nursing cohorts (42.6%) followed by medicine (31.5%) were most common. While publication dates ranged from 1983 to 2016, only five studies pre-date 2000. These five studies were with nursing cohorts, one of which also included other disciplines. Most studies ($n = 31$) were published in 2010 or later. The SDLRS (Guglielmino, 1978) was the most utilized instrument (49.0%), followed by the SDLRSNE (Fisher et al., 2001) (43.1%). A number of studies mentioned using adapted versions of the SDLRS or SDLRSNE. Reasons for using adapted versions included translation to a language other than English (Gagnon, Gagnon, Desmartis, & Njoya, 2013; Klunklin, Viseskul, Sripusanapan, & Turale, 2010; Kocaman, Dicle, & Ugur, 2009; Lee, 2015; Şenyuva & Kaya, 2015; Song, Yun, Kim, Ahn, & Jung, 2015; Yang & Jiang, 2014; Yuan, Williams, Fang, & Pang, 2012), changes for cultural appropriateness (Duman & Sen, 2012; Elzubeir, 2009; Kell & van Deursen, 2000, 2003; Klunklin et al., 2010), changes for use in a particular discipline (Devi, Devan, Soon, & Han, 2012; Gyawali, Jauhari, Ravi Shankar, Saha, & Ahmad, 2011; Monroe, 2016), changes to include items of interest (Elzubeir, 2009) and changes in response to psychometric testing (Tsou et al., 2009).

A wide range of factors, apart from self-directed learning readiness, were examined in the studies. Some studies explicitly set out to investigate these factors as independent variables of primary interest to the study question. Other studies included factors to characterize samples without further exploration of interactions between these and self-directed learning readiness outcomes; while others used factors to explain variance in another variable of interest. Three studies (Alotaibi, 2016a; Kek, Darmawan, & Chen, 2007; Kek & Huijser, 2011) were model validations exploring the effect of a range of factors including self-directed learning readiness on student learning outcomes.

Descriptor	Frequency	Percentage
<i>Country</i>		
United States of America (USA)	10	20.4
Canada	6	12.2
United Kingdom (UK)	6	12.2
Saudi Arabia	4	8.2
India	3	6.1
Malaysia	3	6.1
Turkey	3	6.1
Australia	2	4.1
China	2	4.1
Iran	2	4.1
Nepal	2	4.1
South Korea	2	4.1
Taiwan	2	4.1
Sweden	1	2.0
Thailand	1	2.0
<i>Disciplines</i>		
Nursing	23	42.6
Medicine	17	31.5
Physical Therapy / Physiotherapy	8	14.8
Pharmacy	3	5.6
Occupational Therapy	2	3.7
Dentistry	1	1.9
<i>Instrument used</i>		
SDLRS (Guglielmino, 1978)	25	49.0
SDLRSNE (Fisher et al., 2001)	22	43.1
Competencies for self-directed learning (Knowles, 1975)	1	2.0
Oddi's Continuing Learning Inventory (Oddi, 1986)	1	2.0
Ryan's two part self-assessment questionnaire (Ryan, 1993)	1	2.0
Self-Directed Learning Instrument (Cheng et al., 2010)	1	2.0

Table 4.2 Characteristics of included studies

Discipline	Instrument			Total <i>n</i>
		<i>n</i> (%)		
	SDLRS	SDLRSNE	Other*	
Nursing	11 (47.8)	11 (47.8)	1 (4.4)	23
Medicine	5 (29.4)	9 (52.9)	3 (23.5)	17
Physical Therapy / Physiotherapy	8 (100)	-	-	8
Pharmacy	1 (33.3)	2 (66.7)	-	3
Occupational Therapy	2 (100)	-	-	2
Dentistry	1 (100)	-	-	1

* 'Other' includes *Competencies of Self-Directed Learning*, *OCLL*, *Ryan's two-part self-assessment questionnaire* or *SDLI*.

Table 4.3 Included studies by discipline and instrument used

Factor	Frequency investigated	Significant results
	<i>n</i> (%)	<i>n</i>
<i>Demographic factors</i>		
Gender	17 (34.7)	2
Age	16 (32.7)	6
Ethnicity	5 (10.2)	1
Location	4 (8.2)	0
Tuition financing	2 (4.1)	1
Family occupations	2 (4.1)	0
Dependents	1 (2.0)	0
Marital status	1 (2.0)	0
<i>Educational background</i>		
Previous level of education	11 (22.4)	4
Previous learning experiences	3 (6.1)	1
School type	2 (4.1)	1
<i>Program factors</i>		
Year level	17 (34.7)	11
Program delivery	16 (32.7)	7
Academic program	4 (8.2)	1
Language of instruction	3 (6.1)	2
Entry to program	3 (6.1)	0
Course satisfaction	3 (6.1)	1
<i>Academic factors</i>		
Learning profile	8 (16.3)	4
Academic outcomes	7 (14.3)	3
<i>Professional factors</i>		
Practice interests	2 (4.1)	1
Practice competencies	3 (6.1)	2

Table 4.4 Factors investigated in included studies

As shown in *Table 4.4*, the most commonly investigated factors were gender (34.7%), year level (34.7%), age (32.7%), program delivery (32.7%) and previous level of education (22.4%). Eleven studies reported significant findings which indicate differences in self-directed learning readiness across year levels. Most indicate higher self-directed learning readiness in students who had progressed further in their academic program.

Six studies reported significant findings indicating that self-directed learning readiness increased with age. Another four studies reported significant findings indicating higher self-directed learning readiness in students who previously attempted or completed post-secondary (post-high school) education. Program delivery approach also yielded a number of significant results, but because of the diversity in methods used, no trend could be concluded. Approaches included team-based learning, problem based learning, and online learning.

4.6 Discussion

This purpose of this paper was to identify measures of self-directed learning readiness and the factors that had been examined in student cohorts in pre-certification health professional programs. This was the first review to do so. Two scales dominate self-directed learning readiness measurement: the SDLRS (Guglielmino, 1978) and the SDLRSNE (Fisher et al., 2001). The narrow range of measures elicited in this review appears to be the result of including “readiness” as an essential term in the search. There may be more measures available if self-directed learning without the qualifying “readiness” was the focus of enquiry.

Scoping existing literature on the topic has also identified the breadth of factors investigated and thus considerations for future studies. The review answered the research question posed without difficulty: ‘What factors have been investigated in studies examining self-directed learning readiness of students in pre-certification health professional programs?’ Twenty-one factors were identified in the review. Gender, year level, age, program delivery and previous level of education were commonly investigated in the literature. Few studies yielded significant results relating to gender. Program delivery approaches were too diverse to permit an overall conclusion to be drawn. There is, however, nascent evidence that age, year level and previous level of education could have some relationship with self-directed learning readiness. Each of these factors may contribute independently to self-directed learning readiness, or they may have a combined effect themselves or with other factors such as gender. As yet, sample sizes and study questions in the evidence to date are insufficient to suggest determinants or interaction

effects. One thing, however, that each of these three factors have in common, is the passing of time and the accumulation of life experience – increasing age, program progression and the attainment of previous qualifications all take time and engage individuals in a range of life, study and work experiences. It may be that these factors are proxy measures for more encompassing constructs such as individual cognitive or social development, or individual occupational socialization to the discipline or the health field in general. Further research is needed to investigate what if any independent or combined effect variables other than gender have on self-directed learning readiness and what constructs they may represent.

The effect of student learning profiles or styles on self-directed learning readiness also requires further exploration. Two studies using Kolb's (1976) Learning Style Inventory demonstrated congruent findings with "convergers" and "assimilators" demonstrating increased readiness for self-directed learning (Linares, 1999; O'Kell, 1988). Traditionally, learning styles have been considered to be relatively stable over time (Keefe, 1979; Loo, 1997), however, there may be some disagreement (Peterson, Rayner, & Armstrong, 2009). If learning styles are stable and they have a direct relationship to self-directed learning, then further research is required to help understand whether or not self-directed learning can actually be taught. This will help inform pre-certification curriculum design, program delivery approaches and student support strategies.

In addition to individual student attributes as potential determinants, there also appears to be merit in the further exploration of discipline and program related factors on student's readiness for self-directed learning. If self-directed learning readiness increases with progression in a program, it may in fact be program teaching and learning activities that elicit or enable it. Although several studies examined cohorts in programs that self-identified as requiring higher levels of self-directed learning (such as problem based learning, structured self-directed learning activities, blended learning and distance education) the interaction of program design, pedagogy, teaching and learning activities, assessments and disciplinary/ professional expectations and

program learning outcomes is yet to be examined. Comparison of different disciplinary cohorts at similar levels could be a starting point for such enquiry.

The intention of the scoping review was to answer the research question; however, a number of interesting characteristics have emerged in the results. It is evident in the breadth of studies that self-directed learning readiness is a concept which has attracted the attention of researchers across the world. Inclusion criteria restricted papers to those in English, but the search itself demonstrated that the SDLRS (Guglielmino, 1978) or SDLRSNE (Fisher et al., 2001) was used in a number of studies where English was not the primary language in the country of origin. This suggests that self-directed learning readiness is a factor of interest for pre-certification programs in the health disciplines globally. Eight studies stated using versions of the instruments which had been translated into another language. Another five studies made modifications to the instruments for cultural relevance. Several of these studies either referenced or undertook validation studies which supported use of the modified instruments. It would be interesting for future studies to consider whether culture has an effect on the construct of self-directed learning readiness.

The volume of evidence available from nursing and medicine shows that self-directed learning readiness is a concept of keen interest and attention. Historically, nursing has a strong tradition exploring self-directed learning readiness, and was the only discipline to publish on the topic from the mid-1980s to 1998. It is surprising that allied health disciplines have very limited or no studies when the demand for lifelong learning and self-directed learning competence are inherent in many professional accreditation and registration requirements. It is important that further work is conducted in these disciplines. In the interest of interprofessional education, the most efficient way of undertaking this research is studying students from different professions within interprofessional units. This approach provides profession-specific information at the same time as contributing to evidence about interprofessional learning.

The two dominant instruments were both used across a range of disciplines. The SDLRS (Guglielmino, 1978) was developed using Delphi technique with identified experts in self-directed learning. It was developed for use in general adult populations. The SDLRSNE (Fisher et al., 2001) was also developed through Delphi technique, although with nurse educators and nurse academics, for use with nursing student cohorts. Researchers should consider whether use of either instrument is appropriate for students in particular disciplines. Three studies did reference validation studies to support use of the SDLRSNE in medical cohorts. Interestingly, none of the studies referenced validity testing of either instrument in any of the allied health professions. In light of this, there is a need for validation studies, particularly in the allied health disciplines. There was however evidence relating to psychometric properties of the SDLRS and the SDLRSNE was emerging with internal consistency results promising and work relating to construct validity growing.

4.6.1 Limitations

Despite adherence to the Arksey and O'Malley (2005) framework and the rigorous processes undertaken, the scoping review may not have identified all published literature on the topic. The search strategy used three groupings of search terms: health disciplines, pre-certification students, self-directed learning readiness. While the Boolean search strategy and truncation of terms were used to maximise capture of relevant literature, the researchers deliberately used the term “self-directed learning readiness” and not “self-directed learning”. Initial searches using “self-directed learning” yielded extremely large search results which influenced the decision to use the term “self-directed learning readiness”. Additionally, in the interest of understanding the transition of students from pedagogical to andragogical approaches, the researchers considered the students’ readiness to engage in self-directed learning the important aspect, rather than their ability to do so. The scoping review may also be limited as studies were limited to those published in academic journals in the English language. Future reviews may consider broadening eligibility requirements by including studies published in other languages and exploring grey literature.

4.7 Conclusion

Self-directed learning is a key aspect of teaching and learning approaches, particularly pre-certification programs in the health professions. It is apparent that there are factors which influence a student's readiness for self-directed learning, and many of these have been explored in the literature. Age, gender, program delivery, educational background and year level are factors which are routinely explored, however studies have also investigated a range of other demographic, educational, program, academic and professional factors. A key finding is that age, year level and previous education level may have a positive influence on self-directed learning readiness. These three factors have in common the passing of time, and may in fact be more encompassing developmental or social constructs. Self-directed learning activities may, therefore, be better placed later in the curriculum when students are more ready for self-directed learning. Studies have mostly been conducted with nursing and medical cohorts. Fewer studies have been conducted in only select allied health disciplines. Surprisingly, there are very few studies which investigate self-directed learning readiness in interprofessional cohorts despite the increasing institutional and industry drivers for interprofessional education. Further work is warranted in exploring self-directed learning readiness in the allied health professions, and studies in interprofessional contexts can provide an efficient approach to increasing this knowledge base. Further work is also warranted to determine appropriate use of the two instruments across the range of health disciplines.

4.8 Supplementary material

Study	Country	Disciplines	Instrument	Sample Size (n)	Demographic								Educational			Program							Academic		Professional Interests	Professional competencies	Significant results (Sig.) Not including sub-scale or individual item results				
					Age	Gender	Ethnicity	Marital status	Dependents	Family occupations	Location	Tuition financing	Highest level of previous education	Prior learning experiences	School type	Entry to program	Academic program	Year level	Language of instruction	Course satisfaction	Program delivery	Learning profile	Academic outcomes								
Abraham et al. (2011)	India	Medicine	SDLRSNE	118																				X						• No relevant significant results.	
Alotaibi (2016a)	Saudi Arabia	Nursing Medical Emergency	SDLRSNE	342* *As per Alotaibi (2016b)																				X						* No relevant significant results (Model validation study).	
Badlyepymaie Jabroni, Moslanejad, and Rezaee (2016)	Iran	Nursing	SDRLS	77																				X						• No relevant significant results.	
Cheng et al. (2014)	Taiwan	Nursing	SDLI	387																										• Significant increase in SDLI scores following a team based learning curriculum ($F = -5.57, p < .001$). • Students in 2 year program had significantly higher self-directed learning readiness than students in the 4 year program ($F = -5.77, p < .001$)	
Davis and Pearson (1996)	USA	Nursing	SDLRS	103																										• Students who were more satisfied with the course had significantly higher self-directed learning readiness ($F = 1.63, p = .04$). • Students who had higher course results had significantly higher self-directed learning readiness ($p = .005$). Moderately strong association between self-directed learning readiness and course achievement ($V = .89, C = .78$).	
Dev, Devan, Soon, and Han (2012)	India	Medicine	SDLRSNE (adapted)	120																										• Students who received traditional curriculum had higher self-directed learning readiness than students who received partially problem based learning curriculum ($p = .004$).	
Deyo, Hoyth, Rochester, Sturpe, and Kiser (2011)	USA	Pharmacy	SDLRSNE	153	X	X	X								Sig.											Sig.	X	Sig.			• Students with higher self-directed learning were more likely to have a previous academic degree ($p = .03$). • Students with higher self-directed learning were less likely to pursue a career in community pharmacy ($p = .03$). • Students with higher self-directed learning were more likely to complete pre-laboratory assignments ($p = .001$), meet in study groups ($p = .00496$) and use general internet searches ($p = .017$).
Duman and Sen (2012)	Turkey	Nursing	SDLRSNE (adapted)	47																								Sig.			• There were significant differences in self-directed learning readiness according to year in the program ($F = 16.87, p < .001$). Year 1 students had significantly lower self-directed learning readiness than students in other years (p value not presented). • Negative weak correlation between self-directed learning readiness and locus of control in Year 1 ($r = -.29, p = .047$), Year 2 ($r = -.33, p = .020$), Year 3 ($r = -.32, p = .026$) and Year 4 ($r = -.33, p = .021$).
El-Ghany and Abusaud (2013)	Saudi Arabia	Nursing	SDLRSNE	275	X	X		X				X													X						• No relevant significant results.
Elzubeir (2009)	Saudi Arabia	Medicine	Competencies of SDL (adapted)	43																					X						• No relevant significant results.
Falk, Falk, and Jakobsson Ung (2016)	Sweden	Nursing	SDLRSNE	123																											• No relevant significant results.

Table 4.5 Investigated factors mapped by studies (cont..)

Study	Country	Disciplines	Instrument	Sample Size (n)	Demographic								Educational			Program							Academic		Professional		Significant results (Sig.) Not including sub-scale or individual item results					
					Age	Gender	Ethnicity	Marital status	Dependents	Family occupations	Location	Tuition financing	Highest level of previous education	Prior learning experiences	School type	Entry to program	Academic program	Year level	Language of instruction	Course satisfaction	Program delivery	Learning profile	Academic outcomes	Professional interests	Professional competencies							
Gagnon, Gagnon, Desmaris, and Njaya (2013)	Canada	Nursing	SDLRSNE (adapted)	102																												• Traditional teaching delivery led to significantly greater improvement in self-directed learning readiness than hybrid online delivery among student with low ($p = .01$) and medium ($p = .01$) self-directed learning readiness at baseline. However, hybrid online delivery led to significantly greater improvement in self-directed learning readiness than traditional teaching among student with high self-directed learning readiness at baseline ($p = .02$).
Gyawalk, Jadhari, Ravi Shankar, Saha, and Ahmad (2011)	Nepal	Medicine	SDLRSNE (adapted)	121	X	X							X																			• No relevant significant results.
Harvey, Rothman, and Frecker (2003)	Canada	Medicine	SDLRS OCLI Ryan's	250	Sig.	X							Sig.																			• Scores increased significantly with age in all three instruments (data not presented) • Self-directed learning readiness increased significantly by highest previous qualification attained in SDLRS ($p < .001$), OCLI ($p < .004$), and Ryan's ($p < .001$). • Significant differences between year levels in SDLRS ($p = .028$), OCLI ($p = .01$), and Ryan's ($p = .021$). Students in Year 1 had greater self-directed learning readiness than students in other year levels in Ryan's ($p = .0007$).
Huyth et al. (2009)	USA	Pharmacy	SDLRSNE	77	X	X	X						X											X								• Males had higher self-directed learning readiness than females ($p = .029$).
Kar et al. (2014)	India	Medicine	SDLRSNE	64		Sig.							X																			• No relevant significant results (Model validation study).
Kek, Darmawan, and Chen (2007)	Malaysia	Medicine	SDLRSNE	392	X	X							X	X																		• No relevant significant results (Model validation study).
Kek and Huijser (2011)	Malaysia	Medicine	SDLRSNE	392	X	X							X	X																		• No relevant significant results (Model validation study).
Kell (2006)	UK	Physio-Therapy	SDLRS	123	Sig.	Sig.																										• Mature aged students had significantly higher self-directed learning readiness than school leavers ($p = .016$). • Females had significantly greater self-directed learning readiness than males ($p = .042$). • Significant decline in self-directed learning readiness over time ($p = .002$).
Kell (2007)	UK	Physio-Therapy	SDLRS	52																												• Mature aged students had significantly higher self-directed learning readiness than school levers ($p < .05$).
Kell and van Deusen (2000)	UK	Physio-Therapy	SDLRS (adapted)	43	Sig.																											• No relevant significant results.
Kell and van Deusen (2002)	UK	Physio-Therapy	SDLRS	38 (1994) 45 (1998)																												• No relevant significant results.
Kell and van Deusen (2003)	UK	Physio-Therapy	SDLRS (adapted)	31 (1994) 36 (1998)																												• No relevant significant results.
Kunklin, Visekull, Sripananpan, and Turak (2010)	Thailand	Nursing	SDLRS (adapted)	272																												• Students in Year 4 had significantly higher self-directed learning readiness than those in earlier years ($p = .005$).
Kocaman, Diele, and Ugur (2009)	Turkey	Nursing	SDLRSNE (adapted)	50																												• Students in Year 4 had significantly higher self-directed learning readiness than other year levels ($p < .01$).

Table 4.5 (...cont...)

Study	Country	Disciplines	Instrument	Sample Size (n)	Demographic										Program						Academic		Professional interests	Professional competencies	Significant results (Sig.) Not including sub-scale or individual item results
					Age	Gender	Ethnicity	Marital status	Dependents	Family occupations	Location	Tuition financing	Highest level of previous education	Prior learning experiences	School type	Entry to program	Academic program	Year level	Language of instruction	Course satisfaction	Program delivery	Learning profile	Academic outcomes		
Lee (2015)	South Korea	Nursing	SDLRS (adapted)	86																	X				<ul style="list-style-type: none"> No relevant significant results
Linares (1989)	USA	Nursing	SDLRS	345	Sig.		Sig.										X								<ul style="list-style-type: none"> Age had a significant influence on self-directed learning readiness ($F = 8.83, p > .0032$). Significant difference in self-directed learning readiness between ethnic groups ($p = .0484$). Students who had high self-directed learning readiness were older than those with average or low self-directed learning readiness ($p = .0002$). Subjects (includes students and faculty) who preferred the converger learning style had significantly higher self-directed learning readiness than accommodators, assimilators and divergers ($F = 25.492, p < .001$). There were significant differences in self-directed learning readiness between programs ($p = .00976$). Students who had high self-directed learning readiness had a significantly higher GPA on graduation than students who had average or low self-directed learning readiness ($F = 9.1191, p = .0001$).
Linares (1999)	USA	Nursing Occupational Therapy Physical Therapy Physician Assistant Medical Tech.	SDLRS	566	Sig.	X											Sig.					Sig.			<ul style="list-style-type: none"> Self-directed learning readiness was significantly higher in the last semester of the program compared to the first semester. ($p < .001$)
Malin, Dineen, and Carey (2010)	USA	Occupational Therapy Physical Therapy	SDLRS	86													X	Sig.			X				<ul style="list-style-type: none"> No relevant significant results.
Monroe (2016)	USA	Medicine	SDLRSNE (adapted)	77												X						X		X	<ul style="list-style-type: none"> Self directed learning readiness improved significantly over a clinical internship ($p = .02$)
Mori, Barry, and Brooks (2008)	Canada	Physical Therapy	SDLRS	17																	Sig.				<ul style="list-style-type: none"> Self directed learning readiness improved significantly over a clinical internship ($p = .02$)
O'Kell (1988)	UK	Nursing	SDLRS	158	X								X					Sig.				Sig.			<ul style="list-style-type: none"> Self-directed learning readiness was significantly lower for diverger and accommodator learning styles than for convergers or assimilators (p value not presented). Self-directed learning readiness had a statistically significant relationship with year levels of the program (p value not presented) with students in Year having the highest self-directed learning readiness.
Phillips, Turnbull, and He (2015)	Australia	Nursing	SDLRSNE	59	X	X							Sig.					Sig.							<ul style="list-style-type: none"> A significant difference was found in the total SDLRS scores among qualification levels, $F(4,402) = 3.333, (p = .011)$. There was a significant difference in self-directed learning readiness across year levels $F(2,404) = 5.050, (p = .007)$. Students in Year 1 had significantly lower scores than students in Year 3 ($p = .005$).
Premkumar et al. (2013)	Canada	Medicine	SDLRS	375	Sig.	X							X			X		Sig.							<ul style="list-style-type: none"> Students with three years premedical university education had significantly higher scores in 1 out of 5 cohorts who were older had significantly higher SDLR scores than did younger students ($p = .0027$). There was a significant drop ($p < .001$) in self-directed learning readiness one year after admission.
Premkumar et al. (2014)	Canada	Dentistry	SDLRS	137	X	X							X			X		Sig.							<ul style="list-style-type: none"> There was a significant decline in self-directed learning readiness after Year 1 in four out of five cohorts ($p < .01$).
Razaei and Mostafaei (2015)	Iran	Nursing	SDLRS	40																	X				<ul style="list-style-type: none"> No relevant significant results
Saloo (2016)	Malaysia	Medicine	SDLRS	51		X																			<ul style="list-style-type: none"> No relevant significant results.
Senyova and Kaya (2015)	Turkey	Nursing	SDLRSNE (adapted)	162																	Sig.				<ul style="list-style-type: none"> Self-directed learning readiness increased significantly following completion of an online learning course ($p < .001$)

Table 4.5 (...cont...)

Study	Country	Disciplines	Instrument	Sample Size (n)	Demographic								Educational			Program							Academic		Professional		Significant results (Sig.) Not including sub-scale or individual item results																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
					Age	Gender	Ethnicity	Marital status	Dependents	Family occupations	Location	Tuition financing	Highest level of previous education	Prior learning experiences	School type	Entry to program	Academic program	Year level	Language of instruction	Course satisfaction	Program delivery	Learning profile	Academic outcomes	Professional interests	Professional competencies																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Shankar et al. (2011)	Nepal	Medicine	SDLRSNE	100		X	X			X	X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		</

Table 4.5 (...cont)

4.9 References

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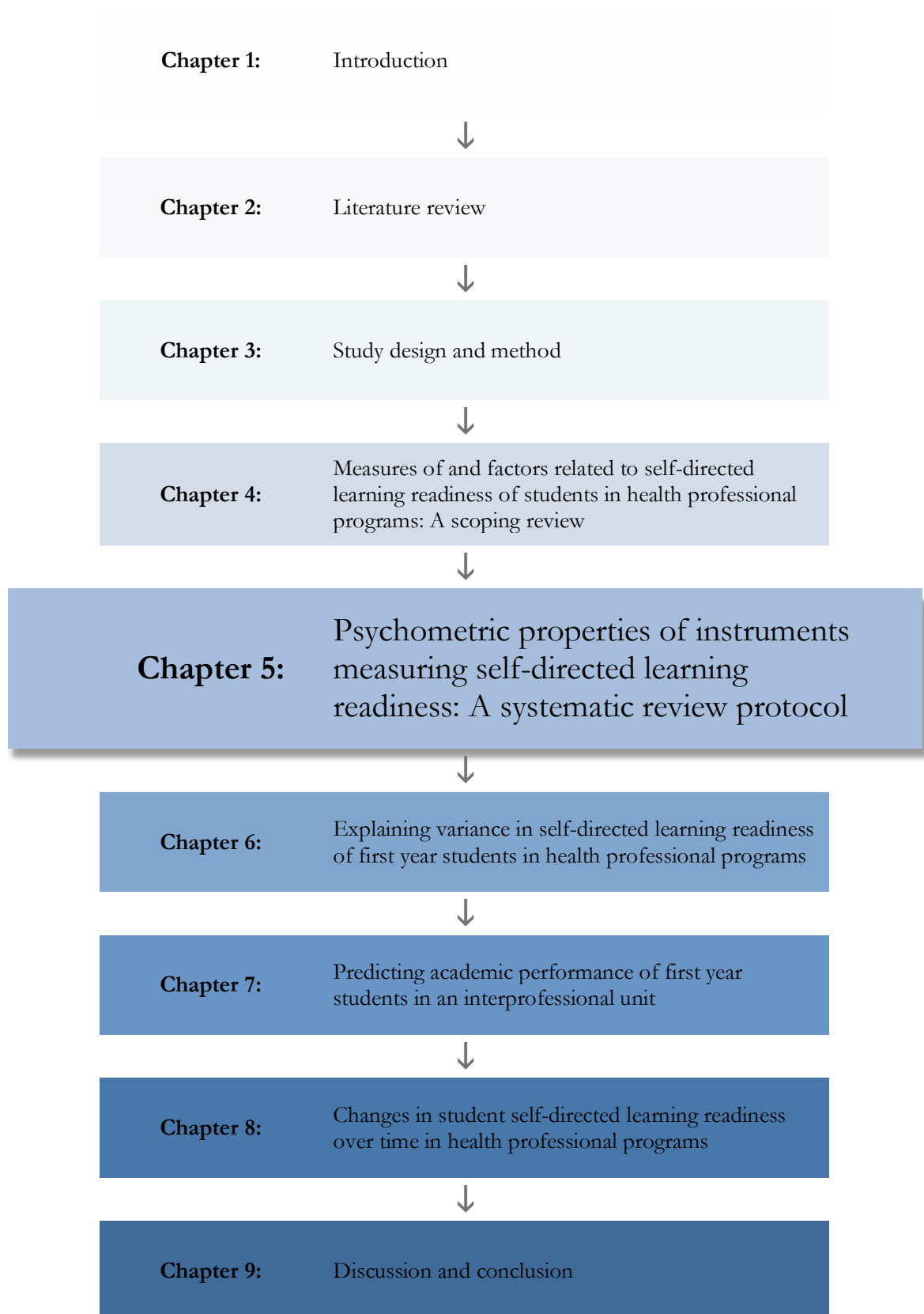


Figure 5.1 Thesis chapter progression: Chapter 5

Chapter 5

Psychometric properties of instruments measuring self-directed learning readiness: A systematic review protocol

This chapter is presented as a manuscript detailing the protocol of the systematic review. In keeping with the PRISMA-P guidelines for systematic reviews (Moher et al., 2015), this protocol has been prospectively registered with PROSPERO (CRD42017078828) (*Appendix S*). The manuscript has been submitted to the journal, *Systematic Reviews*, for peer-review (*Appendix T*).

Journal guidelines:

<https://systematicreviewsjournal.biomedcentral.com/submission-guidelines>

PROSPERO entry:

http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017078828

Author Declaration:

The protocol manuscript was prepared by the candidate, Craig Slater (CS) with supervision of Professor Anne Cusick (AC) as specified in the author contributions statement below.

Author Contribution statement:

CS and AC collaborated in the design of the study. CS was lead investigator for determining the search strategy, developing the protocol, registering the protocol, drafting the manuscript and submitting the manuscript for peer-review to the journal, *Systematic Reviews*. AC reviewed and provided feedback on the search strategy, protocol and manuscript.

This chapter (author statement and preamble) was authored by CS under supervision feedback of AC. The manuscript detailing the protocol of the systematic review is inserted after the preamble. Referencing, heading numbers and table numbers differ from the submitted manuscript in order to maintain formatting consistency throughout the PhD thesis.

5.1 Preamble

This chapter presents a systematic review protocol manuscript for a study investigating the psychometric properties of instruments measuring SDLR. This study addresses *Research Objective 2: to explore the attributes of instruments measuring SDLR of students in health professional programs*. This study builds on the findings of the scoping review (Chapter 4). The scoping review identified six instruments used with students in health professional programs, however of these, most studies used either the SDLRS or the SDLRSNE. The six identified instruments have been developed for, and validated in different population groups such as the general adult population, university students, and nursing students. Many of the instruments have since been adapted to other languages or validated in other population groups. To date, there has been no evaluation and comparison of SDLR instruments used with students in health professional programs. This systematic review protocol outlines a study which will investigate instrument psychometric properties found in the literature, assess the quality of included studies, and synthesize the findings. Evaluation of the strength of evidence is referred to in this thesis as ‘risk of bias assessment’. This will be conducted using the COnsensus-Based Standards for the Selection of Health Status Measurement INstruments (COSMIN) checklist with 4-point scale.

The systematic review described in this chapter will only include studies involving students in health professional programs given the professional and practice drivers for clinicians in the health disciplines to maintain knowledge and skill currency through self-directed, lifelong learning. A detailed description of these professional and practice drivers are presented in *Chapter 1* (Section 1.2), and *Chapter 2* (Section 2.2). The inclusion of studies only involving students in health professional programs, as compared to other university programs, is necessary in identifying instruments which have been validated with student populations in the health disciplines.

The purpose of the study describe in this chapter is not to single out any one instrument as the best instrument to measure SDLR but rather to fill a gap in the existing literature regarding the

critical appraisal of psychometric properties of instruments which measure SDLR. In future research, there are benefits, however, to studies from different health disciplines using the same instrument given validation in the respective populations. Using the same instrument would allow for meaningful comparisons of SDLR between disciplines. It also would provide opportunity for data to be aggregated – a particular benefit for disciplines such as occupational therapy and physiotherapy which have much smaller student cohorts than medicine and nursing. The findings from the systematic review described in this chapter, will help identify the psychometric properties of SDLR instruments used in the health disciplines, and will therefore assist educators and researchers in the selection of instruments for research or program evaluation purposes.

5.2 Abstract

Background: Health professional programs are often required, through accreditation standards, to develop student attitudes and abilities for self-directed, lifelong learning. Different educational approaches have been adopted by programs to increase self-directed learning readiness (SDLR), and researchers have often investigated student changes using standardized instruments. In the literature, several instruments which aim to measure SDLR have been used in cohorts of students in health disciplines, however, to date, there has not been a comparative evaluation of the instruments.

Method: The aim of the systematic review will be to evaluate the psychometric properties of instruments measuring SDLR which have been used in cohorts of students in pre-certification health professional programs. A systematic search of five databases (CINAHL, MEDLINE, PsychINFO, Scopus and Web of Science) will be completed. Search strategies will include search words on three concepts: i) health professions, ii) pre-certification students, and iii) self-directed learning readiness. Quantitative studies published in English in peer-reviewed journals will be included in the review. Methodological quality of included studies will be assessed using the COnsensus-based Standards for the selection of health status Measurement Instruments

(COSMIN) 4-point checklist. Psychometric properties of instruments will be presented through narrative synthesis and tabled, if appropriate.

Discussion: The findings from this systematic review will provide researchers with a synthesis of psychometric properties of instruments which measure SDLR. Recommendations for instrument selection with pre-certification students in the health disciplines will be made which will assist educators and researchers to select the most appropriate instrument for their purpose.

Systematic review registration: CRD42017078828

Keywords: systematic review; protocol; health professions; self-directed learning; instrumentation

5.3 Background

Self-directed learning (SDL) has been of interest in the health professions, largely as it has been understood to be an important skill and attitude for health professionals in maintaining professional knowledge and skill currency. Congruent with Knowles (1975) definition of SDL, health professionals are responsible for taking initiative of their continued learning by identifying their own learning needs, determining strategies to meet these needs, implementing the strategies and evaluating the learning. For most health professionals, maintaining knowledge and skill currency through continued learning is mandatory for keeping professional registration or membership with professional societies. The development of attitudes and abilities in self-directed, lifelong learning has consequently been an accreditation requirement for many health professional programs (e.g. Australian & New Zealand Podiatry Accreditation Council, 2015; Australian Physiotherapy Council, 2017; Occupational Therapy Council, 2015). A variety of approaches have been adopted by health professional programs to develop students' SDL attitudes and abilities of students. These approaches have included problem-based learning (Devi, Devan, Soon, & Han, 2012; Kell & van Deursen, 2002; Tsou et al., 2009), online learning (Şenyuva & Kaya, 2015), and targeted SDL activities (Tao, Li, Xu, & Jiang, 2015). To determine

the impact of these strategies, and the change in students' self-directed learning readiness (SDLR) and abilities over time, educators and researchers in the health disciplines have used a range of instruments which aim to measure SDLR.

A recent scoping review (Slater & Cusick, 2017) identified six instruments which have been used to measure SDLR in cohorts of students in health professional programs; most studies using either the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) or the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher, King, & Tague, 2001). As shown in *Table 5.1*, the instruments used differ in characteristics, development processes, and pilot populations. Several instruments appear to be developed for use with specific populations. Both the SDLRSNE and the Self-Directed Learning Inventory (SDLI) (Cheng, Kuo, Lin, & Lee-Hsieh, 2010) were developed using Delphi technique with nursing education experts and piloted with nursing students. Other instruments appear to have broader application. Oddi's Continuing Learning Inventory (OCLI) (Oddi, 1986) was piloted with university students from diverse programs, and the SDLRS piloted with a wide-ranging adult population. Subsequently, there have been a number validation studies of the SDLRS and the SDLRSNE in other cohorts, particularly with medical students (e.g. Hendry & Ginns, 2009; Hoban, Lawson, Mazmanian, Best, & Seibel, 2005).

There have also been a number of studies in the health disciplines which have used instruments translated into other languages such as Korean (Lee, 2015; Song, Yun, Kim, Ahn, & Jung, 2015), Thai (Klunklin, Viseskul, Sripusanapan, & Turale, 2010), Chinese (Yang & Jiang, 2014; Yuan, Williams, Fang, & Pang, 2012), Japanese (Fujino-Oyama, Maeda, Maru, & Inoue, 2016), French (Gagnon, Gagnon, Desmartis, & Njoya, 2013) and Turkish (Duman & Sen, 2012; Kocaman, Dicle, & Ugur, 2009; Şenyuva & Kaya, 2015). And other studies (e.g. Hendry & Ginns, 2009; Hoban et al., 2005; Tsou et al., 2009) have adapted instruments, often reducing the number of items included.

Instrument	Instrument Characteristics	Development process	Test/pilot population
Competencies of SDL (Knowles, 1975)	9 items; 4-point scale (none, weak, fair, strong); Language = English	Developed as a learning resource but has been adapted and used in the literature as an instrument (Elzubeir, 2009).	Nil – as developed as a learning resource.
SDLRS (Guglielmino, 1978)	58 items; 5 point Likert scale (1=strongly disagree, 5 = strongly agree); Language = English	<ol style="list-style-type: none"> 1. Delphi survey with expert researchers in 'self-direction' 2. Item/scale construction & review 3. Pre-tryout 4. Tryout 5. Factor analysis 6. Psychometric testing 	<p><i>Pre-tryout</i>: Graduate students in education, administrators, adult education specialists, homemakers.</p> <p><i>Tryout</i>: High school students, undergraduate students, and students in adult education classes. (USA)</p>
OCLI (Oddi, 1986)	24 items; 7 point Likert scale (1 = strongly disagree, 7 = strongly agree); Language = English	<ol style="list-style-type: none"> 1. Literature review 2. Content validation with: <ol style="list-style-type: none"> a) graduate students in law, education and nursing b) experts in education and psychology 3. Pre-pilot study 4. Pilot study 5. Factor analyses 6. Psychometric testing 	Graduate students in education, law and nursing programs. (USA)
Ryan's two-part questionnaire (Ryan, 1993)	4 items completed twice (perceived importance, perceived ability); 7 point Likert scale (0 = absent, 1 = low, 6 = high); Language = English	Use of four items from the Competencies of Self-Directed Learning (Knowles, 1975)	Undergraduate nursing students. (Australia)
SDLRSNE (Fisher et al., 2001)	40 items; 3 subscales (self-management, desire for learning, self-control); 5 point Likert scale (1 = strongly disagree, 5 = strongly agree); Language = English	<ol style="list-style-type: none"> 1. Literature review 2. Delphi study with expert nurse academics and nurse educators. 3. Pilot study 4. Factor analysis 5. Psychometric testing 	Undergraduate nursing students. (Australia)
SDLI (Cheng et al., 2010)	20 items; 5 point Likert scale (1 = strongly disagree, 5 = strongly agree); 4 domains (learning motivation, planning and implementation, self-monitoring, interpersonal communication); Language = English / Chinese	<ol style="list-style-type: none"> 1. Literature review 2. Delphi study with experts in adult/higher education and nursing education. 3. Pilot study 4. Confirmatory Factor Analysis 5. Psychometric testing 	Undergraduate nursing students. (Taiwan)

Table 5.1 Characteristics of instruments measuring SDLR

Given the variety of instruments used with cohorts of students in the health disciplines and adaptations of the original instruments, there is a need for a comparative evaluation of instrument psychometric properties. Evaluating the psychometric properties of the instruments from data presented in the existing literature is critical for future research in the health disciplines, so that researchers can make informed decisions about which is the best instrument to use when measuring SDLR. This systematic review will, therefore, address this gap in the knowledge base by answering the following research questions:

- 1) Which instruments measuring self-directed learning readiness have been used with cohorts of students in pre-certification health professional programs?
- 2) What are the psychometric properties of the identified instruments measuring self-directed learning readiness?

5.4 Study design and method

A systematic review of the literature will be conducted to investigate the psychometric properties of instruments measuring SDLR which have been used with students in pre-certification health professional programs. The protocol has been registered on PROSPERO (CRD42017078828).

To answer the research questions, the review will aim to:

- i) identify all the instruments measuring SDLR which have been used with cohorts of students in health professional programs.
- ii) locate all of the existing evidence in the literature which report psychometric properties of the instruments measuring SDLR.
- iii) evaluate the strength of the evidence.
- iv) determine the best measure available for measuring student SDLR in health professional programs.

5.4.1 Eligibility criteria

For inclusion, studies should use an instrument which aims to measure SDLR defined by Wiley (1983) as the degree to which an individual possesses “the attitudes, abilities and personality characteristics for self-directed learning” (p. 182). Only studies conducted with undergraduate, graduate or post-graduate students in pre-certification health professional programs (medicine, dentistry, nursing or allied health professions) will be included. For the purpose of this review, allied health professions are defined using the Australian Health Workforce Advisory Committee (2006) definition which includes the following professions: audiology, dietetics and nutrition, occupational therapy, orthotics and prosthetics, orthoptics, pharmacy, physiotherapy, podiatry, psychology, radiography, speech pathology and social work. All studies must be original research and published in a peer-reviewed journal. Only studies published in English will be included.

5.4.2 Search methods

A search will be conducted in the following electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), Educational Resources Information Center (ERIC), Scopus, Web of Science and PsychINFO (Psychological Abstracts). The search strategy in respective databases will combine text terms on three concepts: 1) health professions, 2) pre-certification students, 3) self-directed learning readiness. The planned search strategy for CINAHL and PsychINFO on EBSCOhost is presented in the *Table 5.2*. Searches with the names of each included instrument in combination with the terms for the study population as described in the search strategy in the attached file will be conducted until each instrument has been searched.

1.	Medicine OR medical OR nursing OR dentistry OR dental OR allied health OR health scienc* OR audiology OR dieteti* OR nutritio* OR occupational therapy OR orthopti* OR orthoti* OR prostheti* OR pharmacy OR physiotherapy OR physical therapy OR podiatr* OR chiropody OR psychology OR radiography OR speech pathology OR speech therapy OR speech language therapy OR speech language pathology OR social work
2.	undergraduate OR graduate OR postgraduate OR university students
3.	self directed learning readiness OR self-directed learning readiness
4.	1 AND 2 AND 3

Table 5.2 Search strategy for CINAHL and PsychINFO on EBSCOhost

5.4.3 Screening

Citation details (author, title, journal, year and abstract) of studies found in the database searches will be imported into EndNote and duplicates removed. Data will then be exported to a Microsoft Excel spreadsheet. Two independent reviewers (CS and AC) will screen the title and abstract of all studies against the eligibility criteria. Where there is disagreement, the reviewers will re-read the title and abstract and discuss until consensus agreement reached. The two reviewers will then independently read the full-text of studies of which were not eliminated in the screening process and determine studies for inclusion, again using the listed eligibility criteria. Disagreement between reviewers will again be resolved through re-reading and discussion until a consensus is reached or referring the paper to a third reviewer to make the final decision.

5.4.4 Data extraction

Data will be extracted by one reviewer (CS) using a data extraction form developed by the researchers, and independently cross checked by two other reviewers (AC and JL). Data extracted from studies will include: citation details (author, title, journal, year), location/s of the study, discipline/s involved, study design, instrument/s used, sample size, brief summary of findings, and psychometric properties presented.

5.4.5 Risk of bias assessment

Studies which present psychometric properties of an instrument measuring SDLR of students in health professional programs will be assessed for methodological quality using the COnsensus-Based Standards for the Selection of Health Status Measurement INstruments (COSMIN) checklist with 4-point scale (excellent, good, fair, poor). Assessment will be conducted by one reviewer (CS) and cross checked by two independent reviewers (AC and JL). The COSMIN checklist evaluates the quality of individual studies with regards to the following psychometric properties: internal consistency, reliability, measurement error, content validity, structural validity, hypothesis testing, cross-cultural validity, criterion validity, responsiveness, interpretability and generalizability. Only the sections relevant to psychometric data presented will be used.

5.4.6 Data analysis

Tabled results and a narrative synthesis of the findings from this review will be presented. There will be a comparison of the instruments included in the review, and recommendations for educators and researchers about use of the instruments in future research.

5.4.7 Data management

EndNote (version 7.7.1) will be used in the screening described above. Microsoft Excel (version 15.34) will be used to chart the screening, data extraction, and critical appraisal processes.

5.5 Discussion

This study will provide detailed information about the psychometric properties of instruments measuring SDLR from studies in the health disciplines. The findings of the review will provide guidance to educators and researchers on which instruments which provide a rigorous and relevant measure of SDLR in cohorts of students in pre-certification health professional programs.

5.6 Manuscript information

5.6.1 List of abbreviations

SDLR - Self-directed learning readiness

COSMIN - COnsensus-based Standards for the selection of health status Measurement
INstruments

SDL - Self-directed learning

SDLRS - Self-Directed Learning Readiness Scale

SDLRSNE - Self-Directed Learning Readiness Scale for Nursing Education

OCLI - Oddi's Continuing Learning Inventory

CINAHL - Cumulative Index to Nursing and Allied Health Literature

MEDLINE - Medical Literature Analysis and Retrieval System Online

ERIC - Educational Resources Information Center

PsychINFO - Psychological Abstracts

5.6.2 Ethics approval

Not applicable

5.6.3 Consent to publish

Not applicable

5.6.4 Availability of data and materials

Not applicable

5.6.5 Competing interests

The authors report no conflicts of interest. The authors alone are responsible for the content and the writing of the article.

5.6.6 Funding

None received

5.6.7 Author's contribution

CS and AC collaborated in the design of the study. CS was lead investigator for determining the search strategy, developing the protocol, registering the protocol, and drafting the manuscript. AC reviewed and provided feedback on the search strategy, protocol and manuscript.

5.6.8 Acknowledgements

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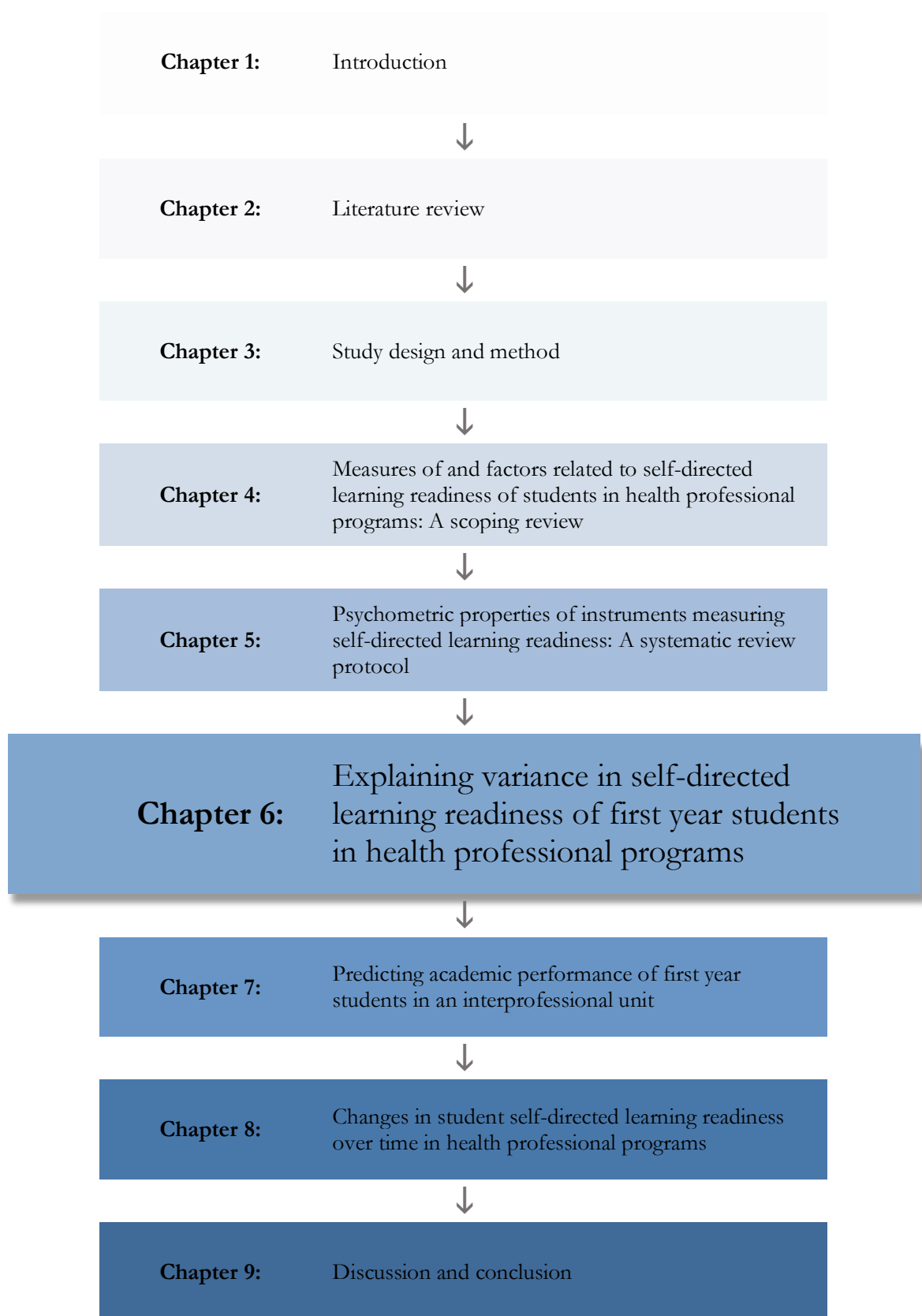


Figure 6.1 Thesis chapter progression: Chapter 6

Chapter 6

Explaining variance in self-directed learning readiness of first year students in health professional programs

This chapter is the pre-print version of a paper published in the peer reviewed journal *BMC Medical Education*. The letter of acceptance for publication in the journal is shown in *Appendix R*.

Slater, C.E., Cusick, A. & Louie, J.Y.C (2017) Explaining variance in self-directed learning readiness of first year students in health professional programs. *BMC Medical Education*, 17, 207. doi: [10.1186/s12909-017-1043-8](https://doi.org/10.1186/s12909-017-1043-8)

Link to publication: <https://bmcmmeduc.biomedcentral.com/articles/10.1186/s12909-017-1043-8>

Journal author guidelines: <https://bmcmmeduc.biomedcentral.com/submission-guidelines>

Author Declaration: The manuscript draft was prepared by the candidate (CS) with supervision of Professor Anne Cusick (AC) and Dr. Jimmy Louie (JL) as specified in the author contributions statement below.

Author Contribution statement:

CS led the study design, data collection, analysis, drafting of the full version of the original submitted manuscript and revised versions following *BMC Medical Education* reviewer feedback. AC participated in the study design, data collection, analysis, drafting of the manuscript and manuscript revisions from reviewer feedback. JL participated in the analysis and drafting of the manuscript.

This chapter (author statement and preamble) was authored by CS under supervision feedback of AC and JL, with the pre-print version of the published paper inserted after the preamble. Referencing, heading numbers and table numbers differ from the submitted manuscript in order to maintain formatting consistency throughout the PhD thesis.

6.1 Preamble

This chapter presents a cross-sectional study investigating the factors which influence SDLR of first year students in seven health professional programs. This chapter builds on the findings from the scoping review (*Chapter 4*) in addressing *Research Objective 1: to determine the factors which influence SDLR of students in health professional programs*. It also informs *Research Objective 3: to determine changes in students' SDLR between first year, first semester and third year, second semester*, by examining students' SDLR on entry to programs.

The scoping review (*Chapter 4*) identified that gender, age, and previous education were among the most common factors investigated for potential association with SDLR in health professional programs. Each of these factors also had indicative evidence of potential association with SDLR: gender (Kar et al., 2014; Kell, 2006), age (Harvey, Rothman, & Frecker, 2003; Kell, 2006; Kell & van Deursen, 2000; Linares, 1989, 1999; Premkumar et al., 2013), and previous education level (Deyo, Huynh, Rochester, Sturpe, & Kiser, 2011; Harvey et al., 2003; Phillips, Turnbull, & He, 2015; Williams, 2004). Given that most of these studies had occurred in medicine and nursing contexts, it was important to explore their potential association in other health disciplines, such as those investigated in this study. These three factors were included in the cross-sectional study presented in this chapter, as well as the 'Big Five' personality factors which have previously never been investigated for association with SDLR in the health disciplines.

As discussed in *Chapter 4*, there is nascent evidence in the literature that age, year level and previous education level may have positive influence on student SDLR. Furthermore, these three factors have in common the passing of time and the accumulation of life experience. They, therefore, may be proxy for more encompassing developmental or social constructs. The scoping review in *Chapter 4* identified no studies in the health disciplines which investigated 'work experience' for association with student SDLR, and therefore, it was not considered for inclusion in the current study. In the context of Knowles, Holton, and Swanson's (2015) revised adult learning theory, work experience may contribute to maturation and transition in to

adulthood. Future researchers may consider investigating the influence of work experience on student SDLR, and the relationship it has with the factors age, year level and previous education level.

The rationale for including personality in this study was primarily to determine whether SDLR is a personality trait which is stable over time, as suggested by Lounsbury (2009); or whether SDLR is amenable to change through curricular intervention. This is an important consideration given that professional accreditation standards often require academic programs in the health disciplines to *develop* students' attitudes and abilities for self-directed, lifelong learning over the duration of the program. If it was found that SDLR was in fact a trait, there would be considerable implications for accreditation standards set out by respective professional accreditation bodies, teaching and learning approaches used in health professional training bodies, and more broadly, for professional practice. It is, therefore, surprising that personality has never been previously investigated for association with SDLR in the health disciplines.

The 'Big Five' factors are considered broad domains of personality. As such, Goldberg (1992) did not determine specific definitions of each domain, but rather described various traits related to each domain. John and Srivastava (1999) synthesized descriptions of the 'Big Five' factors as:

- extraversion* traits such as being talkative, energetic and assertive.
- agreeableness* traits such as being good-natured, cooperative and trustful.
- conscientiousness* traits such as being orderly, responsible and dependable.
- emotional stability* traits such as being calm versus neurotic, and not easily upset.
- intellect/imagination* traits such as being independent-minded, open-minded and insightful.

The rationale for use of the SDLRS (Guglielmino, 1978) in this study (*Chapter 6*) is presented in detail in *Chapter 3* (Section 3.5.1). The SDLRS was also selected as is the most commonly used SDLR instrument in the health disciplines, as identified in *Chapter 4* of this thesis. This study also provides a unique comparison of findings across several programs. As determined in the

scoping review (*Chapter 4*), most studies have investigated SDLR in single discipline cohorts, largely in nursing and medicine. For several of the disciplines involved, this study presents the first known SDLR data. It is also the only known study in the health disciplines to have developed a regression model explaining variance in SDLR. Implications for education programs arising from the current study are discussed in detail in *Chapter 9*, section 9.6.1.

6.2 Abstract

Background: Self-directed learning (SDL) is expected of health science graduates; it is thus a learning outcome in many pre-certification programs. Previous research identified age, gender, discipline and prior education as associated with variations in students' self-directed learning readiness (SDLR). Studies in other fields also propose personality as influential.

Method: This study investigated relationships between SDLR and age, gender, discipline, previous education, and personality traits. The Self-Directed Learning Readiness Scale and the 50-item 'Big Five' personality trait inventory were administered to 584 first-year undergraduate students ($n = 312$ female) enrolled in a first-session undergraduate interprofessional health sciences subject.

Results: Students were from health promotion, health services management, therapeutic recreation, sports and exercise science, occupational therapy, physiotherapy, and podiatry. Four hundred and seven responses ($n = 230$ females) were complete. SDLR was significantly higher in females and students in occupational therapy and physiotherapy. SDLR increased with age and higher levels of previous education. It was also significantly associated with 'Big Five' personality trait scores. Regression analysis revealed 52.9% of variance was accounted for by personality factors, discipline and prior experience of tertiary education.

Conclusion: Demographic, discipline and personality factors are associated with SDLR in the first year of study. Teachers need to be alert to individual student variation in SDLR.

Keywords: Self-directed learning; Education, Professional; Interdisciplinary studies, Students, Health Occupations.

6.3 Introduction

Universities and academic programs have long had interest in understanding students' readiness to engage in self-directed learning (SDL). Understanding pre-certification students' readiness for SDL can assist educators to meaningfully and effectively prepare students for SDL in a professional and practice context. The classic definition by Knowles (1975) describes SDL as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p.18). While SDL is a desired academic and professional trait, there is little insight into what might make students 'ready' to engage in this process. In the case of pre-certification students, will they be 'ready' for SDL as a result of attributes and experience they bring with them to training? Alternatively, will they be 'ready' as a result of their teaching and learning experiences?

As such, student self-directed learning readiness (SDLR) has been the subject of research inquiry. A recent review of the literature relating to factors associated with students' SDLR revealed that demographic, educational, and discipline and factors were most commonly investigated (Slater & Cusick, 2017).

Increasing age has been consistently associated with increasing levels of SDLR (Harvey et al., 2003; Kell, 2006; Kell & van Deursen, 2000; Linares, 1989, 1999; Premkumar et al., 2013). Previous levels of education also positively affect SDLR; that is, the higher the qualification on entry into the program, the higher the SDLR (Harvey et al., 2003; Williams, 2004). It takes time to get higher qualification levels, so this could be a function of age, but this has not been independently assessed. The time/age interaction could also explain why year levels show

differences. A number of studies show SDLR increases with program progression (Duman & Sen, 2012; Klunklin, Viseskul, Sripusanapan, & Turale, 2010; Kocaman, Dicle, & Ugur, 2009; Phillips et al., 2015); although equally this could relate to the teaching and learning experiences in the programs. This, however, has generally not been teased out. The fact that some studies (Kell, 2006; O'Kell, 1988; Premkumar et al., 2014) have found SDLR *decreases* with increasing program level is illustrative. Perhaps teaching and learning experiences over time rather than age per se are more influential.

Gender is the other factor most commonly investigated in pre-certification health professional program cohorts (Slater & Cusick, 2017). The relationship between gender and SDLR was significant in only two studies (Kar et al., 2014; Kell, 2006) which had opposite results. In many studies, the association between gender and SDLR had not been meaningfully explored because samples have been overwhelmingly female. This may in part account for the ambiguity about association.

Discipline has received limited research attention. Most studies use single-discipline samples: medicine (Harvey et al., 2003; Kar et al., 2014; Premkumar et al., 2013; Shokar, Shokar, Romero, & Bulik, 2002); nursing (Davis & Pearson, 1996; Gagnon, Gagnon, Desmartis, & Njoya, 2013; Phillips et al., 2015; Williams, 2004); physiotherapy (Kell, 2006; Kell & van Deursen, 2000, 2002, 2003); pharmacy (Deyo et al., 2011; Huynh et al., 2009; Walker & Lofton, 2003); and dentistry (Premkumar et al., 2014). Few studies use multidisciplinary cohorts, and of those that do, comparison between disciplines has not been of particular interest. Linares (1999) and Malta, Dimeo, and Carey (2010) found differences in SDLR between select programs, however, in both studies these differences were not statistically investigated. No studies to date have included cohorts in specifically interprofessional classes.

Apart from age, gender, prior education level and discipline, quantitative investigation into other educational, program and academic determinants of SDLR levels has been scant. Surprisingly,

there are few studies exploring the influence of traits, such as personality, which has shown influence on student academic success in general (Doherty & Nugent, 2011). This is in spite of an emerging debate in literature regarding whether or not SDLR can actually be ‘taught’. Lounsbury, Levy, Park, Gibson, and Smith (2009), for example, suggests that SDLR is in fact an attribute or trait, rather than a self-report proxy for performance capacity which can change over time. Surprisingly, although standardised tools have been available for many decades to investigate individual traits such as personality, to date no research has explored whether traits such as personality are associated with SDLR levels in health disciplines in general and pre-certification programs in particular.

This study examined factors previously found to be associated with SDLR level – gender, age, previous educational level and discipline – and included a measure of personality as a new factor. The study then considered whether the factors of most influence were amenable to instruction. The study builds on the evidence base by investigating previously explored factors in a new cohort; first year undergraduate pre-certification students engaged in interprofessional study at the beginning of their program. Some of the disciplines in this cohort have never previously had SDLR data presented. The study presents SDLR profiles for the cohort as a whole and for each discipline. It investigated associations for the cohort as a whole and for each discipline; and for the whole cohort a regression model is presented.

6.4 Method

A single cohort cross-sectional survey design was used. Ethics approvals were obtained from the Western Sydney University Human Research Ethics Committee (H9857) and the University of Wollongong/Illawarra and Shoalhaven Local Health District Human Research Ethics Committee (HE12/226) including approval to extract student demographic and program data from institutional records, and match to completed surveys. The matched dataset was de-identified for research purposes.

6.4.1 Participants

A total of 584 undergraduate students were enrolled in a first year, first semester interprofessional health science subject at a metropolitan university in New South Wales, Australia. Enrolled students were from the following programs: health sciences (majors in therapeutic recreation, health promotion and health services management) ($n = 158$); sport and exercise science ($n = 215$); occupational therapy ($n = 86$); physiotherapy ($n = 71$); and podiatry ($n = 54$).

6.4.2 Instruments

Students completed the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) and the 'Big Five' personality trait inventory (Goldberg, 1992) from the International Personality Item Pool (IPIP) (Goldberg, 1999).

The SDLRS is a 58 item self-report survey measuring the complex of attitudes, skills, and characteristics that comprise an individual's current level of readiness to manage his or her own learning. The SDLRS is the most commonly used instrument to measure self-directed learning readiness in pre-certification cohorts in the health disciplines (Slater & Cusick, 2017). The instrument asks participants to select one of five responses which best reflects their own attitude or preference towards learning. Total scores range from 58 to a possible total of 290, with higher scores indicating increased readiness for self-directed learning. Guglielmino and Associates (n.d) reported a mean score of 214 ± 25.6 within a range of 189 to 240 in the general adult population. Mean scores of undergraduate students in health disciplines have ranged between 208.48 ± 17.62 (Klunklin et al., 2010) and 238.70 ± 21.0 (Harvey et al., 2003). The instrument has a split-half reliability of $r = 0.94$ (Guglielmino & Guglielmino, 1991) and test-retest reliability coefficients of $r = 0.79$ (Wiley, 1983) and $r = 0.82$ (Finestone, 1984), as reported by Guglielmino and Associates. There is a nursing version called the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher, King, & Tague, 2001). The SDLR was selected for the study because there were no nurses in this sample.

The 'Big Five' personality trait inventory is a 50-item inventory derived from Goldberg's (1992) 100-item inventory and is commonly used in the interest of time efficiency. There are ten items related to each of the five factors: 'extraversion', 'agreeableness', 'conscientiousness', 'emotional stability', and 'intellect/imagination'. Participants choose one of five responses which reflect how accurately the item describes them. Responses to items are scored between one and five, and the sum is tallied for each of the five factors. Total scores range from a minimum of 10 to possible total of 50 for each factor. The instrument has a mean internal consistency across the five factors of $\alpha = 0.84$, and average correlation with factor markers of $r = 0.67$ and as per the IPIP website (<http://ipip.ori.org/>). Further work by Gow, Whiteman, Pattie, and Deary (2005) showed internal consistencies ranging $\alpha = 0.72$ to $\alpha = 0.87$ in a university student population in Scotland and confirmed the five-factor structure.

6.4.3 Data Collection

All students were asked to complete the surveys online within the first 12 weeks of program commencement as a non-assessable learning activity. Students could give consent for responses to be used in research. Permission was granted by the university for the following data to be extracted from enrolment records and linked to survey responses: age, gender, program of enrolment, and highest level of previous education. All matched data were de-identified by an independent administrative officer prior to researcher access.

6.4.4 Data Analysis

Data were analysed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to characterise the sample on demographic, academic, personality and SDLRS variables. One-way analysis of variance (ANOVA) were used to compare SDLRS scores between academic programs and students' educational backgrounds. *Post-hoc* Bonferroni analyses were then conducted to determine significant differences between specific academic programs and educational backgrounds. An independent t-test was used to compare mean SDLRS scores

of males and females. Pearson's correlation was used to identify relationships between SDLRS scores and both age and personality factors. Effect size of the potential determinants on SDLRS scores was calculated using Cohen's d for t-test analyses, and eta squared (η^2) for ANOVA analyses. Multiple regression was conducted to construct a model explaining the relationship between investigated factors and SDLRS scores. Statistical significance was set at $p < 0.05$.

6.5 Results

6.5.1 Characteristics of the sample

The survey was completed by 456 students, a response rate of 78%. Of these, 407 consented to have their responses used in the research. Demographic attributes and mean academic results of the sample across programs are presented in *Table 6.1*. Overall, there were more females than males and across programs (177 male, 230 female) which was statically significant, $\chi^2(4) = 78.33$, $p < 0.001$. Most students had entered the program following completion of their final year of secondary education. Across programs, there was also a significant difference between student's highest level of previous education, $\chi^2(24) = 50.86$, $p < 0.001$. Podiatry had greater representation of students who had an incomplete or complete bachelor's degree, and fewer students who had completed secondary education than the expected counts. There were no significant differences across programs in the personality factors 'extraversion', 'emotional stability' or 'intellect/imagination'. There were, however, differences in the factors 'agreeableness' $F(4,398) = 5.45$, $p < 0.001$, and 'conscientiousness' $F(4,398) = 3.02$, $p = 0.02$. The mean age across programs was 20 years, with differences in age across programs $F(4,402) = 5.250$, $p < 0.001$.

6.5.2 Gender

Females had higher SDLR than males. As shown in *Table 6.2*, SDLRS scores were significantly higher for females (215.53 ± 25.46) than for males (209.11 ± 23.19), $t(405) = 2.62$, $p = 0.009$, $d = 0.264$. Both scores are within the range for average self-directed learning readiness (202-226) (Guglielmino and Associates, n.d).

6.5.3 Age

Older students had higher SDLR, than younger students. As shown in *Table 6.3*, there was a weak positive correlation between SDLRS scores and age ($r = 0.266, p < 0.001$).

6.5.4 Highest level of previous education

SDLRS scores differed significantly depending on the student's highest level of previous education $F(6,400) = 4.720, p < 0.001, \eta^2 = 0.066$. A post-hoc Bonferonni test revealed that there was a statistically significant difference between students who had completed their final year of secondary education (208.45 ± 23.67) and students who had previously commenced a bachelor level program but not completed ($219.84 \pm 26.61; p = 0.005$); and students who had completed their final year of secondary education and students who had previously completed a bachelor level degree ($231.83 \pm 24.24; p = 0.001$).

6.5.5 Disciplinary differences

There was a statistically significant difference in mean SDLRS scores across disciplines $F(4,402) = 5.267, p < 0.001, \eta^2 = 0.05$ (*Table 6.2*). A post-hoc Bonferroni test showed that the difference in mean SDLRS scores was statistically significant between students in (a) health sciences (therapeutic recreation, health promotion and health services management) (209.47 ± 27.21) and occupational therapy ($220.29 \pm 24.86; p = 0.05$); (b) sports and exercise science (207.51 ± 22.66) and occupational therapy ($220.29 \pm 24.86; p = 0.003$); and (c) sports and exercise science (207.51 ± 22.66) and physiotherapy ($219.23 \pm 22.40; p = 0.016$).

6.5.6 Personality

SDLR was associated with increased scores on each of the 'Big Five' personality factors. In the whole cohort, there was a weak positive correlation with SDLR and both 'emotional stability' ($r = 0.17, p = 0.001$) and 'extraversion' ($r = 0.22, p < 0.001$). There was a moderate positive correlation with 'agreeableness' ($r = 0.44, p < 0.001$) and 'conscientiousness' ($r = 0.48, p < 0.001$). There was a strong positive correlation with 'intellect/imagination' ($r = 0.541, p < 0.001$).

	Health Science	Sports and Exercise Science	Occupational Therapy	Physiotherapy	Podiatry	TOTAL
<i>n (%)</i>	94 (23.1)	148 (36.4)	69 (17.0)	61 (15.0)	35 (8.6)	407
Gender, <i>n (%)</i>						
Male	22 (23.4)	95 (64.2)	7 (10.1)	32 (52.5)	21 (60.0)	177 (43.5)
Female	72 (76.6)	53(35.8)	62 (89.9)	29 (47.5)	14 (40.0)	230 (56.5)
Highest level of previous education, <i>n (%)</i>						
No previous qualification / other qualification	3 (3.2)	7 (4.7)	1 (1.4)	0 (0.0)	0 (0.0)	11 (2.7)
Complete secondary education	62 (66.0)	92 (62.2)	40 (58.0)	44 (72.1)	12 (34.3)	250 (61.4)
Incomplete vocational level program	1 (1.1)	4 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)	5 (1.2)
Complete vocational level program	8 (8.5)	21 (14.2)	7 (10.1)	1 (1.6)	4 (11.4)	41 (10.1)
Incomplete bachelor's degree level program	12 (12.8)	23 (15.5)	17 (24.6)	11 (18.0)	13 (37.1)	76 (18.7)
Complete bachelor's degree level program	5 (5.3)	1 (0.7)	3 (4.3)	4(6.6)	5 (14.3)	18 (4.4)
Unknown	3 (3.2)	0 (0.0)	1 (1.4)	1 (1.6)	1 (2.9)	6 (1.5)
Personality factor, <i>mean ± SD</i>						
Extraversion	33.76 ± 6.42	35.20 ± 6.03	33.42 ± 6.74	33.90 ± 5.54	33.26 ± 7.30	34.21 ± 6.31
Agreeableness	41.86 ± 5.38 ^a	39.49 ± 5.56 ^{ab}	42.73 ± 5.41 ^b	40.49 ± 4.57	40.14 ± 5.73	40.78 ± 5.49
Conscientiousness	35.08 ± 6.15	33.54 ± 6.15 ^c	36.28 ± 6.38 ^c	35.84 ± 6.63	35.51 ± 5.87	34.86 ± 6.30
Emotional stability	31.30 ± 8.79	33.66 ± 7.74	31.73 ± 7.16	33.46 ± 7.83	32.65 ± 8.44	32.69 ± 8.00
Intellect/imagination	36.21 ± 6.52	35.84 ± 5.03	36.46 ± 5.48	36.70 ± 5.86	34.71 ± 6.09	36.06 ± 5.69
Mean age, <i>years ± SD</i>	19.70 ± 3.44 ^d	19.79 ± 4.49 ^e	21.43 ± 6.72	19.21 ± 4.03 ^f	23.17 ± 7.41 ^{def}	20.25 ± 5.08

^a Difference between sport and exercise science and health science students was statistically significant ($p = 0.01$).

^b Difference between sport and exercise science and occupational therapy students was statistically significant ($p = 0.001$).

^c Difference between sport and exercise science and occupational therapy students was statistically significant ($p = 0.03$).

^d Difference between podiatry and health science students was statistically significant ($p = 0.005$).

^e Difference between podiatry and sport and exercise science students was statistically significant ($p = 0.003$).

^f Difference between podiatry and physiotherapy students was statistically significant ($p = 0.002$).

Table 6.1 Characteristics across programs

	Health Science (n=94)	Sports and Exercise Science (n=148)	Occupational Therapy (n=69)	Physiotherapy (n=61)	Podiatry (n=35)	TOTAL (n=407)
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Cohort	209.47 \pm 27.21*	207.51 \pm 22.66 ⁺ ^	220.29 \pm 24.86 ⁺⁺	219.23 \pm 22.40 [^]	217.40 \pm 23.26	212.74 \pm 24.68
Gender						
Male	202.14 \pm 21.27	204.81 \pm 21.06	214.86 \pm 34.94	220.59 \pm 23.12	216.43 \pm 23.63	209.11 \pm 23.19
Female	211.71 \pm 28.54	212.36 \pm 24.75	220.90 \pm 23.77	217.72 \pm 21.89	218.86 \pm 23.51	215.53 \pm 25.46
Highest level of previous education						
No previous qualification / other qualification	225.00 \pm 9.17	210.43 \pm 25.48	#	-	-	217.45 \pm 22.98
Complete secondary education	202.21 \pm 24.83	205.78 \pm 22.81	217.93 \pm 24.14	213.73 \pm 20.92	210.25 \pm 21.56	208.45 \pm 23.67
Incomplete vocational level program	#	206.00 \pm 20.15	-	-	-	204.40 \pm 17.81
Complete vocational level program	223.63 \pm 20.44	210.57 \pm 17.65	223.71 \pm 30.29	#	212.00 \pm 34.24	215.98 \pm 22.33
Incomplete Bachelor degree level program	223.75 \pm 34.62	208.65 \pm 24.53	221.88 \pm 25.17	232.55 \pm 23.70	222.62 \pm 22.18	219.84 \pm 26.61
Complete Bachelor degree level program	233.00 \pm 27.27	#	220.33 \pm 34.39	237.75 \pm 16.15	226.80 \pm 23.89	231.83 \pm 24.24
Unknown	213.67 \pm 22.50	-	#	#	#	220.17 \pm 18.62

Data not presented as only one respondent.

* Difference between health science and occupational therapy was statistically significant (p = 0.05).

+ Difference between sport and exercise science and occupational therapy students was statistically significant (p = 0.003).

^ Difference between sport and exercise science and physiotherapy students was statistically significant (p = 0.016).

Table 6.2 SDLRS scores by program and demographic factors

	Health Science (<i>n</i> = 94)			Sports and Exercise Science (<i>n</i> = 148)			Occupational Therapy (<i>n</i> = 69)			Physiotherapy (<i>n</i> = 61)			Podiatry (<i>n</i> = 35)			TOTAL (<i>n</i> = 407)		
	<i>r</i>	<i>p</i>		<i>r</i>	<i>p</i>		<i>r</i>	<i>p</i>		<i>r</i>	<i>p</i>		<i>r</i>	<i>p</i>		<i>r</i>	<i>p</i>	
Age	0.390	< .001		0.208	0.011		0.159	0.193		0.349	0.006		0.368	0.030		0.266	< 0.001	
Personality factor																		
Extraversion	0.224	0.032		0.292	< 0.001		0.191	0.121		0.156	0.229		0.444	0.008		0.222	< 0.001	
Agreeableness	0.331	0.001		0.407	< 0.001		0.582	< 0.001		0.439	< 0.001		0.587	< 0.001		0.441	< 0.001	
Conscientiousness	0.490	< 0.001		0.406	< 0.001		0.377	0.002		0.565	< 0.001		0.610	< 0.001		0.477	< 0.001	
Emotional stability	0.291	0.005		-0.009	0.910		0.231	0.060		0.169	0.193		0.545	0.001		0.172	0.001	
Intellect /imagination	0.616	< 0.001		0.506	< 0.001		0.620	< .001		0.486	< 0.001		0.477	0.004		0.541	< 0.001	

Table 6.3 SDLRS score correlation with age and personality factor

Variable	B	SE	β	<i>t</i>	<i>p</i>	Tolerance	VIF
(Constant)	47.550	9.391		5.063	< 0.001		
Age	0.315	0.216	0.063	1.456	0.146	0.673	1.486
Female	-0.477	2.150	-0.10	-0.222	0.825	0.690	1.449
Vocational/Higher Education	7.191	2.214	0.139	3.248	0.001	0.697	1.435
Personality factor							
Extraversion	0.144	0.166	0.036	0.866	0.387	0.731	1.368
Intellect/imagination	1.682	0.179	0.388	9.386	< 0.001	0.747	1.339
Conscientiousness	0.924	0.163	0.235	5.657	< 0.001	0.739	1.353
Agreeableness	1.132	0.189	0.251	5.988	< 0.001	0.726	1.377
Emotional Stability	0.236	0.120	0.075	1.959	0.051	0.872	1.147
Program							
Occupational Therapy	7.645	2.876	0.116	2.658	0.008	0.668	1.498
Physiotherapy	10.670	2.993	0.155	3.565	< 0.001	0.674	1.484
Podiatry	9.186	3.706	0.105	2.479	0.014	0.719	1.390
Sports and Exercise Science	2.710	2.523	0.053	1.074	0.284	0.535	1.870

Table 6.4 Multiple regression analysis of student's self-directed learning readiness

6.5.7 Accounting for variability in SDLR

Multiple regression analysis was used to develop a model for explaining variance in SDLR from the factors investigated: age, gender, previous level of education and personality. Descriptive statistics and regression coefficients are presented in *Table 6.4*. Due to insufficient numbers, students whose previous educational background was unknown ($n = 6$) and students who had no previous/other educational background ($n = 11$) were not included in the regression. Educational background was grouped as 0 = completed secondary education and 1 = commenced or completed vocational or higher education.

A significant regression equation was found $F(12,368) = 34.464, p < 0.001$, with an R^2 of 0.529. The scores of students who had either commenced or completed vocational or higher education were 7.19 points higher than students who had only completed high school, controlling for age, gender, discipline and personality factors. ‘Conscientiousness’ ($p < 0.001$), ‘agreeableness’ ($p < 0.001$), and ‘intellect/imagination’ ($p < 0.001$) were each significant with each additional point in those scales associated with a respective increase of 0.92, 1.13 and 1.68 marks in the SDLRS, when holding the other factors constant. The SDLRS scores of physiotherapy students were 10.67 marks higher ($p < 0.001$), podiatry students 9.12 marks higher ($p = 0.014$), occupational therapy students 7.65 marks higher ($p = 0.008$), and sports and exercise science students 2.71 marks higher ($p = 0.284$) than students in health sciences (therapeutic recreation, health promotion and health services management). There were no significant differences between genders or with age.

6.6 Discussion

The aim of this study was to investigate potential determinants of SDLR in first year students from a range of health disciplines who were enrolled in an interprofessional subject and to explain variability in SDLR. Previously investigated factors of age, gender, highest level of

previous education and discipline were examined and a new factor of personality included. Congruent with the existing literature, SDLR increased with age and with level of previous education. With regard to previous education, there appeared to be a cumulative effect with SDLR scores increasing as the level of previous education increased from secondary education, to students who commenced but did not finish a Bachelor level program and those who completed a Bachelor's level program.

This sample had a better gender balance than many previous studies which have been overwhelmingly female. This meant the association between gender and SDLR could be meaningfully explored. Gender was associated with SDLR; females had higher scores than males. This lends support to previous findings by Kell (2006) similarly in an undergraduate program, however their study was in the United Kingdom and only examined physiotherapy students. Given the routine use of gender as a factor to characterize samples it is surprising that so little evidence is available about the influence of this factor. While this study contributes important information regarding males, further work using samples with good representation from both genders is needed.

This study was the first to investigate the influence of personality on SDLR in undergraduate health discipline students. There was a significant positive relationship between SDLR and scores on each of the 'Big Five' factors: 'extraversion', 'agreeableness', 'conscientiousness', 'emotional stability', and 'intellect/imagination'.

There was also a relationship between disciplines and SDLR score. We observed that the highest mean SDLRS scores were achieved in the programs which were the most competitive to gain entry into. Academic entry threshold scores were between 10 and 30 points higher in occupational therapy, physiotherapy, and podiatry, compared to the other programs, and SDLR means were higher in occupational therapy, physiotherapy and podiatry. This observation is of particular interest when considered in light of personality findings that showed the strongest of

all trait relationships was between ‘intellect/imagination’ and higher SDLR. If entry scores are taken as a ‘proxy’ for academic ability and/or capacity, these findings invite speculation that traits may indeed be associated with SDLR variation but this should be further investigated. This, may provide useful insights particularly as SDLR is expected for health professionals in a diverse disciplinary environment.

This study is one of a few to investigate the practical significance of findings using effect size – most studies only report statistical significance. Lakens (2013) iterates that effect size is useful in communicating the practical significance of results using standardised metrics, allowing researchers to draw meta-analytic conclusions by comparing across studies, and in planning future studies, particularly with respect to power analyses and sample sizes. Using Cohen’s (1988) guidelines, gender ($d = 0.264$), age ($r = 0.266$), highest previous level of education ($\eta^2 = 0.066$) and discipline ($\eta^2 = 0.05$) each presented only small effects. At best, age was nearing the medium effect threshold of 0.3. The implications of this result are that (a) there may be other factors not considered (for example cultural or linguistic background), or (b) it is actually the combination of these factors which is important (e.g., age could be intimately linked to the time taken to get higher qualifications, or the ability to pursue previous qualifications could indicate higher academic ability related to specific disciplines) or (c) one or more of the factors examined are proxy measures for another construct not as yet named. Each of the ‘Big Five’ personality traits, however, showed independent effects (ranging from small to large), with ‘intellect/imagination’ demonstrating a large effect ($r = 0.54$). From a variables point of view, this study highlights the need for age, gender and discipline to be routinely included and reported as potential influencing factors. Further it highlights the value in moving beyond ‘one-size-fits-all’ demographic indicators to variables that may tell us more about students as individual people – their personality and academic capacity or performance. This will help teachers and researchers gain a more nuanced understanding of influencing factors. Expanding the range of factors examined in SDLR research may also help inform debate regarding whether or not SDLR can be ‘taught’ and what factors moderate increases or decreases over time.

This study explains much of the observed variance in SDLR. Regression analyses revealed that personality factors ('intellect/imagination', 'conscientiousness', 'agreeableness' and 'emotional stability') together with prior post-secondary education (complete or incomplete), and discipline (occupational therapy, physiotherapy and podiatry) accounted for 52.9% of variance. Prior SDLR research has not attempted to account for variance, which makes the contribution of this adequately powered multi-factor study to a useful one to educators and health professionals alike. Study findings highlight the need for future SDLR research to explore characteristics like personality, to better understand what factors may be potent in SDLR.

The study presents information that will contribute to the debate regarding whether or not SDLR can be taught. The regression analysis provided a model where much of the variance was accounted for by traits. Firstly, four of the 'Big Five' personality factors were significant in the model. In trait theory, personality traits are considered to be relatively stable over time (Roberts, Wood, & Caspi, 2008). Thus, since personality traits were associated with varying SDLR in this study, it may be reasonable to propose that personality traits "predispose" students to higher or lower SDLR. This has implications for education; it may be that certain 'dispositions' provide students with habits, ways of thinking or emotions that align more or less with behaviours encapsulated in SDLR. But whether or not SDLR is a "trait" per se, as suggested by Lounsbury et al. (2009), needs investigation. One approach for such investigation is to see whether SDLR changes over time, given traits are relatively stable.

Study findings, while being suggestive of the involvement of traits, also suggest that there are aspects of SDLR which are related to learning. Previous level of education was significant in the regression analysis, controlling for age, yet age alone was not significant. This indicates that there must be 'something' learned in previous higher education experiences which influenced SDLR, given temporal or developmental factors (as indicated by age) do not appear to have an effect. Research is needed to determine if there are generic skills or attitudes learned across

higher education experiences which influence SDLR, or whether exposure to particular disciplines' teaching and learning approaches yields greater influences. Irrespective of the degree to which SDLR can be taught, it is evident that different educational strategies may be needed in health professional training, given the diversity of students, both in personality traits and previous educational experiences.

6.6.1 Limitations

This study was conducted at one metropolitan university as a single cohort cross-sectional study. There is, therefore, limited opportunity for comparison across a range of disciplines and locations. Also, given this study is the first of its kind to explain variance in SDLR of students in pre-certification health discipline programs, there is no comparative study.

6.7 Conclusion

Congruent with the existing literature, SDLR increases with age, highest level of previous education, and most notably, with increasing scores in each of the 'Big Five' personality traits. While each of the factors investigated had a modest association with SDLR, in combination, personality traits and previous education level could account for half the variance. Further research should explore how individual student characteristics such as personality (investigated here), and other factors not explored such as cultural and linguistic diversity, socio-economic status and academic capacity, might affect SDLR. Further research should include not only self-report measures of SDLR but also in performance measures where behaviour indicative of SDLR can be observed. As workforce diversity expands and expectations for graduate SDL capacity continue, future research needs to consider all possible influences on readiness.

6.8 Manuscript information

6.8.1 List of abbreviations

SDL – Self-directed learning

SDLR – Self-directed learning readiness

SDLRS – Self-Directed Learning Readiness Scale

IPIP – International Personality Item Pool

SDLRSNE - Self-Directed Learning Readiness Scale for Nursing Education

ANOVA –Analysis of variance

6.8.2 Ethics approval

Approvals for this study were obtained from the Western Sydney University Human Research Ethics Committee (H9857) and the University of Wollongong/Illawarra and Shoalhaven Local Health District Human Research Ethics Committee (HE12/226). Participants indicated consent for use of survey data in future research, and retrospective approval for use of data was provided by both Human Research Ethics Committees.

6.8.3 Consent to publish

Not applicable

6.8.4 Availability of data and materials

The data is presented in summarised form in the tables presented in the manuscript. De-identified data which adheres to ethical approval requirements may be available from the corresponding author on reasonable request.

6.8.5 Competing interests

The authors report no conflicts of interest. The authors alone are responsible for the content and the writing of the article.

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6.8.7 Author's contribution

CS led the study design, data collection, analysis and drafting of the manuscript. AC participated in the study design, data collection, analysis and drafting of the manuscript. JL participated in the analysis and drafting of the manuscript. All authors have read and approved the final manuscript.

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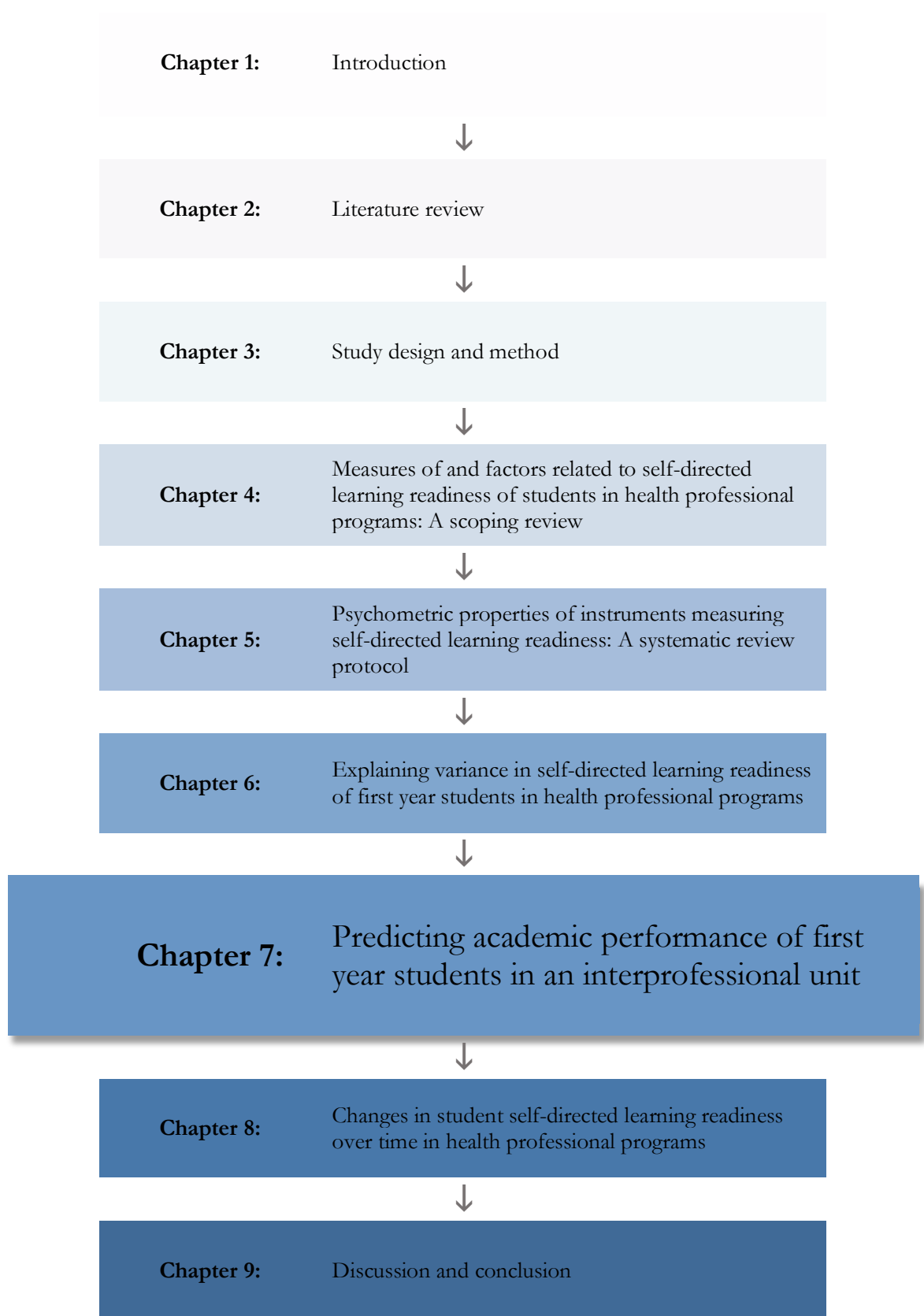


Figure 7.1 Thesis chapter progression: Chapter 7

Chapter 7

Predicting academic performance of first year students in an interprofessional unit

This chapter is a manuscript which has been prepared for submission to the peer reviewed journal, *Journal of Allied Health*.

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Author Declaration:

The manuscript draft was prepared by the candidate, Craig Slater (CS) with supervision of Professor Anne Cusick (AC) and Dr Jimmy Louie (JL) as specified in the author contributions statement below.

Author Contribution statement:

CS led the study design, data collection, analysis, and drafting of the manuscript. AC participated in the study design, data collection, analysis, and drafting of the manuscript. JL participated in the analysis and drafting of the manuscript.

This chapter (author statement and preamble) was authored by CS under supervision feedback of AC and JL, with the manuscript prepared for submission to the *Journal of Allied Health* inserted after the preamble. Referencing, heading numbers and table numbers differ from the manuscript for submission to the journal, in order to maintain formatting consistency throughout the PhD thesis.

7.1 Preamble

This chapter presents a cohort study investigating the influence of SDLR, age, gender, previous education, program, and personality factors on student academic performance in a first year, first semester interprofessional unit. This chapter addresses *Research Objective 4: to determine the influence of student SDLR on academic performance*. The study presents new internal consistency data for the SDLRS and as such, also addresses *Research Objective 2: to explore the attributes of instruments measuring SDLR*. The previous chapter identified that several personality factors had influence on student SDLR. This study builds on this finding, and explores the influence of personality factors on academic performance. Comparisons between the influence of personality factors and SDLR on academic performance add to the conversation about whether SDLR is a trait. Few studies have investigated the influence of SDLR on student academic performance. This study adds to the limited body of evidence on this topic. The size of the sample provided a unique opportunity to conduct regression analysis and develop a model explaining variance in academic performance.

7.2 Abstract

Background: Competence of students in health professional programs has been measured through a number of methods, including student performance on assessments or demonstration of knowledge or skill in action. There are a number of factors which have been investigated in the literature for potential association with students' academic performance. While self-directed learning readiness (SDLR) has been of particular interest in the health disciplines, few studies have investigated the utility of SDLR in influencing academic performance.

Methods: This study investigated the influence of SDLR, age, gender, discipline, previous education and personality factors on academic performance of students in a first year, first semester interprofessional health sciences unit. The Self-Directed Learning Readiness Scale and the 50-item 'Big Five' personality trait inventory were administered to 584 undergraduate students ($n = 312$ female) from health promotion, health services management, therapeutic recreation, sport

and exercise sciences, occupational therapy, physiotherapy and podiatry disciplines. Academic performance was total subject mark out of 100, calculated 14 weeks after commencement measures.

Results: Four hundred and seven students ($n = 230$ female) participated in the study (78% of total cohort). Analysis revealed a significant positive relationship between SDLR and academic performance with discipline variations. Academic performance was significantly higher in: females; physiotherapy and occupational therapy disciplines; students who had previously commenced or completed a higher education program; and was associated with the personality traits ‘conscientiousness’, ‘agreeableness’, and ‘intellect/imagination’. A predictive model was developed where gender and program accounted for 25.9% of the variance.

Conclusion: This study confirms previous research that shows females having higher SDLR than males. Students who had previous higher education experience had higher SDLR than school-leavers. The potential for prior education to be a proxy for “motivation”, however, cannot be discounted. Occupational therapy and physiotherapy had markedly higher SDLR than the other disciplines. The discipline variations in SDLR suggest that education factors may influence SDLR. First, current curricula: notwithstanding the sample’s enrolment in a compulsory interprofessional unit, each student had unique profession-related subjects introducing disciplinary competencies to varying levels. Second, each discipline had threshold variations in the ranked academic scores used for entry into programs, which may be a proxy for variation in academic ability.

Keywords: self-directed learning; academic performance; students, health occupations; interdisciplinary studies.

7.3 Introduction

Student academic performance is influenced by a range of intrinsic and extrinsic factors. Research enquiry has attempted to understand the extent to which academic performance is influenced by the attributes students have on enrolment, the approaches students have to learning, and the environment in which the learning takes place. Understanding the influence of these factors informs program admission processes, curricular teaching and learning approaches, and ultimately graduate outcomes.

Self-directed learning has been a concept of much interest to researchers and educators in the health disciplines. There has been particular interest in students' self-directed learning readiness (SDLR); that is, the degree to which an individual possesses "the attitudes, abilities and personality characteristics for self-directed learning" (Wiley, 1983, p. 182). This is because pre-certification health professional programs aim to develop student self-directed, lifelong learning attitudes and skills, considered to be necessary for maintaining knowledge and skill currency in health professional practice (Australian Medical Council, 2012; Australian Nursing & Midwifery Accreditation Council, 2012; Occupational Therapy Council, 2013).

SDLR of pre-certification students in health professional programs has been investigated for association with a range of factors including: demographic factors (e.g. age, gender and ethnicity); previous educational experiences, curriculum factors (e.g. discipline and program delivery); academic factors (e.g. learning style profile and academic results); and professional interests and competencies (Slater & Cusick, 2017). Most studies, have had limitations however, by being underpowered, having disproportionately high female representation or focused on only one discipline. Studies have also largely been with nursing or medical students, with few in other disciplines. There are, however, three trends in findings to date: (a) SDLR increases with age; (b) SDLR generally increases with year of study; and (c) SDLR increases with level of prior education (Slater & Cusick, 2017). Personality has also been identified to account for SDLR variance (Slater, Cusick, & Louie, 2017).

SDLR is an important aspect of professional preparation but to date it has not been demonstrated to be, on its own, an indicator of pre-certification health student competence. Competence in professional preparation courses is measured through assessments designed to quantify levels of attainment in knowledge and skill through graded or pass/fail activities that require either self-report of knowledge (e.g. in exams) or demonstration of knowledge and skill in action (e.g. in vivas or supervised practice). Whether or not SDLR is related to academic performance is thus a question relevant not only to proponents of SDLR but also to educators who design the assessments used to assure competence through demonstrated levels of attainment.

The relationship between SDLR and academic performance has, to date, been measured in only a small number of studies ($n=7$) (Slater & Cusick, 2017). Of these, four reported significant positive associations between SDLR and either grade point average (GPA) (Alotaibi, 2016; Linares, 1999), total subject results (Davis & Pearson, 1996), or performance in clinical clerkships (Shokar, Shokar, Romero, & Bulik, 2002). Despite the self-evident importance of understanding the relationship between SDLR and academic performance, there is surprisingly little evidence available.

In medical and nursing literature, personality has been widely explored for association with student academic performance. Across the existing literature in these disciplines, it is apparent that the personality factor ‘conscientiousness’ has a significant association with student course grades (Finn et al., 2015; Helle, Nivala, Kronqvist, & Ericsson, 2010; Lievens, Coetsier, De Fruyt, & De Maeseneer, 2002; Lievens, Ones, & Dilchert, 2009; Sobowale, Ham, Curlin, & Yoon, 2018). There is evidence of associations between academic performance and other ‘Big Five’ personality factors (‘agreeableness’, ‘extraversion’, ‘emotional stability’ and ‘intellect/imagination’) (Helle et al., 2010; Lievens et al., 2002; Lievens et al., 2009; Sobowale et al., 2018); however, the evidence is limited and the findings are inconsistent. Several studies which conducted regression analyses

(Ferguson, James, O’Hehir, Sanders, & McManus, 2003; Helle et al., 2010; Lievens et al., 2002; Lievens et al., 2009) also found that ‘conscientiousness’ was significant in predictive models explaining variance in academic performance of medical students. A structured literature review of personality factors in medical education (Doherty & Nugent, 2011) also concluded that ‘conscientiousness’ is an important predictor of academic success in medical training.

While much research investigating the influence of the ‘Big Five’ personality factors on academic performance has occurred in medical and nursing disciplines, far fewer studies have been conducted in the other health disciplines. Additionally, in other health disciplines, studies have either investigated other aspects of personality (ie – not the ‘Big Five’ personality factors) (Brown, Williams, & Etherington, 2016; Tan, Meredith, & McKenna, 2004); or have investigated performance on professional licensing examinations following completion of the academic program (Galleher, Rundquist, Barker, & Chang, 2012). It was, therefore, important that the ‘Big Five’ personality factors were included in the current study to determine whether the same relationships between personality and student academic performance are evident in the seven disciplines investigated, as compared with the medical and nursing literature.

This study will examine the influence of SDLR on academic performance of first year students enrolled in seven different health science disciplines who were undertaking a compulsory interprofessional unit as part of their program. The final unit grade was used to measure academic performance. The study will also present associations and effect sizes for each of the factors investigated, and then present these in a model to explain variance. Since academic performance was measured by end-of-semester total results and participant characteristics were collected from commencement (age, gender, prior education, discipline) or 8 weeks after commencement (SDLR, personality) this model is predictive.

7.4 Method

7.4.1 Participants

Participants of the study were enrolled in a first year, first semester interprofessional health science unit offered on one campus of a metropolitan multi-campus university. Interprofessional units provide a unique opportunity where students across disciplines are engaged in the same learning, receive the same educational input, and complete the same assessment tasks. This allows for meaningful comparison of academic performance across disciplines. Five hundred and eighty-four students were enrolled in the unit from the following disciplines: one of three health sciences majors in therapeutic recreation, health promotion and health services management ($n = 158$); sport and exercise science ($n = 215$); occupational therapy ($n = 86$); physiotherapy ($n = 71$); and podiatry ($n = 54$). The unit was compulsory for each of these disciplines. The interprofessional unit introduced students to the professional competencies for working in the health field, and used traditional face-to-face teaching and learning approaches (weekly lecture and tutorial with online 'homework').

7.4.2 Study Procedure

This study analyzed data from a baseline self-report survey and end-of-semester unit result to investigate the relationship of SDLR and other factors on academic performance of students in undergraduate health professional programs. Students completed the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) and the 'Big Five' personality trait inventory (Goldberg, 1992) from the International Personality Item Pool (IPIP) (Goldberg, 1999) as non-assessable, online learning activities from week 8 of the unit.

Students in the current study were the first to be enrolled in this new unit, and as such, students were asked to complete these two instruments to inform quality improvement efforts and the evaluation of teaching and learning approaches used in the unit. Administering the SDLRS in students' first year in an interprofessional unit was an efficient method of collecting SDLR data across programs. It was important to collect this data so that programs could then measure change

in SDLR over time. This would then inform and provide evidence of how programs met their respective accreditation standards regarding developing students' attitudes and abilities for self-directed, lifelong learning (Australasian College of Health Service Management, 2016; Australian & New Zealand Podiatry Accreditation Council, 2015; Diversional Therapy Australia, 2017; Exercise & Sports Science Australia, 2013; Occupational Therapy Council, 2013; Physiotherapy Boards of Australia and New Zealand, 2015). The 'Big Five' was administered to inform educators about whether there were intrinsic, non-curricular factors which influenced student learning. Across all 13 teaching weeks, including week 8, students engaged with a one-hour lecture, a one-hour tutorial, and a series of online activities, readings or resources. In week 8, the online activity was completion of these two instruments.

Students could give consent for their responses to be used in research. Student data including age, gender, discipline, previous education, and academic result in the unit were extracted from institutional records and matched to completed surveys by an independent administrative officer. The complete dataset was de-identified prior to researcher access. The study protocol including use of institutional data was approved by Western Sydney University [H9857] and the University of Wollongong/Illawarra and Shoalhaven Local Health District [HE12/226] Human Research Ethics Committees.

7.4.3 Instruments

The SDLRS (Guglielmino, 1978) is the most commonly used instrument to investigate student SDLR in the health disciplines (Slater & Cusick, 2017). It is a 58-item instrument with total scores ranging from 58 to 290, and a reported mean of 214 ± 25.6 in an adult population (Guglielmino and Associates, n.d). Students select one of five responses to each item to best reflect their attitude or preferences to learning. The SDLRS has been used with undergraduate students in allied health programs, namely physiotherapy (Kell, 2006; Kell & van Deursen, 2000, 2002, 2003; Kell, 2007; Mori, Batty, & Brooks, 2008), occupational therapy (Linares, 1999; Malta, Dimeo, & Carey, 2010).

In the current study, the SDLRS demonstrated very good internal consistency with, Cronbach's $\alpha = 0.93$ for the whole cohort, and between 0.91 – 0.94 across programs (*Table 7.1*).

The 'Big Five' personality inventory (Goldberg, 1992) is a 50 item self-report questionnaire in which participants select one of five responses. The inventory has five factors: 'extraversion', 'agreeableness', 'conscientiousness', 'emotional stability' and 'intellect/imagination'. The instrument has been found to be valid and reliable when used with undergraduate university students (Gow, Whiteman, Pattie, & Deary, 2005), and has been used with physical therapy student cohorts (Giberson, Black, & Pinkerton, 2008). The IPIP website indicates the instrument has internal consistency of $\alpha = 0.84$ and average correlation with factor marker of $r = 0.67$. In the current study, the 'Big Five' demonstrated good internal consistency with, Cronbach's $\alpha = 0.87$ for the whole cohort, and between 0.83 – 0.92 across programs (*Table 7.1*).

7.4.4 Data Analysis

Data were analysed using SPSS™ version 22.0 (IBM Corp., Armonk, NY, USA). The sample was characterized using descriptive statistics. Analysis of academic results and gender used independent t-tests. Analyses of academic results and both discipline and previous level of education were conducted using one-way analyses of variance (ANOVAs) and post-hoc Bonferroni analyses. The correlation between academic results and each of age, personality and SDLR were derived using Pearson's correlation. The effect size of factors investigated were determined using Cohen's d for t-test analyses, and eta squared for ANOVA analyses. A predictive model was constructed using multiple linear regression with statistical significance set at $p < 0.05$. Standard multiple regression was used and, therefore, all factors (independent variables) were entered into the equation simultaneously. This approach was used to ascertain the contribution of each factor to variance in academic result.

7.5 Results

7.5.1 Characteristics of the sample

There were 456 students who completed the survey, of which 407 consented for their responses to be used in research. There were 387 students who went on to complete the unit and achieve a numerical academic result out of 100. As shown in *Table 7.1*, students in sports and exercise science had the greatest representation in the sample, and podiatry students the least representation. There were statistically significant differences in SDLR across disciplines $F(4, 373) = 4.674, p = 0.001$ (higher in occupational therapy and podiatry). The sample had more females ($n = 216$) than males ($n = 162$). There were significant differences between students' highest level of previous education, $\chi^2(24) = 50.67, p = 0.001$, with most students entering after completing secondary (high school) education as their highest qualification ($n = 244$). There were statistically significant differences across disciplines in the personality factors 'agreeableness' $F(4, 369) = 4.871, p = 0.001$ (higher in occupational therapy and health sciences majors), and 'conscientiousness' $F(4, 369) = 2.760, p = 0.028$ (higher in occupational therapy and podiatry). There were no significant differences between other personality factors. The mean age was 20 years (students older in podiatry), however there were significant differences between programs, $F(4, 373) = 5.138, p < 0.001$.

7.5.2 Influence of variables on academic result

As shown in *Table 7.2*, there was a significant weak positive correlation with academic results and SDLRS scores ($r = 0.23, p < 0.001$). There was no significant correlation between age and academic result. Across disciplines, there was a significant weak positive correlation with academic result and three of the personality factors: 'conscientiousness' ($r = 0.21, p < 0.001$), 'agreeableness' ($r = 0.17, p = 0.001$) and 'intellect/imagination' ($r = 0.14, p = 0.006$). As shown in *Table 7.3*, females (73.76 ± 9.00) scored significantly higher academic results than males (69.87 ± 9.61), $t(376) = -4.039, p < 0.001, d = -0.417$. There were also significant differences in academic result according to student's highest level of previous education $F(6, 371) = 2.607, p = 0.017, \eta^2 = 0.040$.

There was a significant association between discipline and academic result, $F(4,373) = 20.38, p < 0.001, \eta^2 = 0.179$. A post-hoc Bonferroni test revealed that there was a statistically significant difference in academic result between students in the health science majors (68.27 ± 8.84) and both occupational therapy ($76.93 \pm 9.15, p < 0.001$) and physiotherapy ($78.85 \pm 8.76, p < 0.001$); sports and exercise science (69.68 ± 8.10) and both occupational therapy ($76.93 \pm 9.15, p < 0.001$) and physiotherapy ($78.85 \pm 8.76, p < 0.001$); and physiotherapy (78.85 ± 8.76) and podiatry ($73.12 \pm 8.72, p = 0.029$).

7.5.3 Predicting academic performance

A model was developed to predict academic results using multiple regression analysis. Each of the factors investigated were included in the model: the baseline factors of SDLR, age, gender, highest educational level, discipline and personality; and the end-of-unit result out of 100. Students who had no previous educational qualification ($n = 10$) or whose educational background was unknown ($n = 4$) were not included in the analysis due to insufficient numbers.

The total variance explained by the model as a whole was 25.9%, $F(16, 338) = 7.385, p < 0.001$. As shown in *Table 7.4*, gender and discipline predicted academic result; whereas previous education, SDLR and the 'Big Five' personality traits were not predictive. Specifically, females had academic results 2.7 marks higher than males ($p = 0.012$). Students in the following disciplines had higher marks in rank order when compared to students in the health science majors: physiotherapy 11.234 marks higher ($p < 0.001$); occupational therapy 7.440 marks higher ($p < 0.001$); podiatry 5.271 marks higher ($p < 0.001$); and sports and exercise science 3.607 marks higher ($p = 0.004$).

	Health Science	Sports and Exercise Science	Occupational Therapy	Physiotherapy	Podiatry	TOTAL
<i>n</i> (%)	92 (24.34)	139 (36.77)	61 (16.14)	53 (14.02)	33 (8.73)	378 (100)
SDLR, <i>mean</i> ± <i>SD</i>	209.32 ± 27.45	207.16 ± 23.09 ^a	219.85 ± 24.75 ^a	218.13 ± 22.56	218.73 ± 23.02	212.28 ± 24.88
Gender, <i>n</i> (%)						
Male	21 (22.83)	88 (63.31)	6 (9.84)	27 (50.94)	20 (60.61)	162 (42.9)
Female	71 (77.17)	51 (36.69)	55 (90.16)	26 (49.06)	13 (39.39)	216 (57.1)
Highest level of previous education, <i>n</i> (%)						
No previous qualification / other qualification	3 (3.26)	6 (4.32)	1 (1.64)	-	-	10 (2.65)
Complete secondary education	61 (66.30)	87 (62.59)	40 (65.57)	44 (83.02)	12 (36.36)	244 (64.55)
Incomplete vocational level studies	1 (1.09)	4 (2.88)	-	-	-	5 (1.32)
Complete vocational level studies	8 (8.70)	21 (15.11)	6 (9.84)	1 (1.89)	4 (12.12)	40 (10.58)
Incomplete bachelor degree level studies	12 (13.04)	20 (14.39)	10 (16.39)	5 (9.43)	12 (36.36)	59 (15.61)
Complete bachelor degree level studies	5 (5.43)	1 (0.72)	3 (4.92)	2 (3.77)	5 (15.15)	16 (4.23)
Unknown	2 (2.17)	-	1 (1.64)	1 (1.89)	-	4 (1.06)
Personality factor, <i>mean</i> ± <i>SD</i>						
Extraversion	33.78 ± 6.32	35.17 ± 6.01	33.41 ± 6.63	34.21 ± 5.55	33.39 ± 7.50	34.26 ± 6.27
Agreeableness	41.86 ± 5.44 ^b	39.50 ± 5.49 ^{b,c}	42.73 ± 5.50 ^c	40.75 ± 4.40	40.36 ± 5.72	40.83 ± 5.47
Conscientiousness	35.10 ± 6.22	33.41 ± 6.14 ^d	36.25 ± 6.47 ^d	35.30 ± 6.65	35.60 ± 5.96	34.73 ± 6.33
Emotional stability	31.33 ± 8.76	34.01 ± 7.62	31.69 ± 7.14	33.58 ± 8.13	32.63 ± 8.68	32.82 ± 8.04
Intellect/imagination	36.19 ± 6.59	35.78 ± 5.15	36.58 ± 5.12	37.23 ± 5.66	34.94 ± 6.19	36.14 ± 5.69
Mean age, <i>years</i> ± <i>SD</i>	19.68 ± 3.43 ^e	19.81 ± 4.47 ^f	20.89 ± 6.15	18.87 ± 3.73 ^g	23.27 ± 7.62 ^{e,f,g}	20.12 ± 4.93
SDLRS internal consistency, <i>Cronbach's</i> α	0.94	0.92	0.94	0.92	0.91	0.93
'Big Five' internal consistency, <i>Cronbach's</i> α	0.90	0.83	0.86	0.86	0.92	0.87

^a Difference between sport and exercise science and occupational therapy students was statistically significant ($p = 0.008$).

^b Difference between health science and sport and exercise science students was statistically significant ($p = 0.013$).

^c Difference between sport and exercise science and occupational therapy students was statistically significant ($p = 0.001$).

^d Difference between sport and exercise science and occupational therapy students was statistically significant ($p = 0.037$).

^e Difference between health science and podiatry students was statistically significant ($p = 0.003$).

^f Difference between sports and exercise science and podiatry students was statistically significant ($p = 0.002$).

^g Difference between physiotherapy and podiatry students was statistically significant ($p < 0.001$)

Table 7.1 Sample characteristics and instrument internal consistency across programs

	Health Science (<i>n</i> = 92)		Sports and Exercise Science (<i>n</i> = 139)		Occupational Therapy (<i>n</i> = 61)		Physiotherapy (<i>n</i> = 53)		Podiatry (<i>n</i> = 33)		Total (<i>n</i> = 378)	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
SDLR	0.201	0.055	0.151	0.073	0.195	0.132	0.184	0.188	0.019	0.915	0.229	< 0.001
Age	0.047	0.654	0.131	0.125	0.109	0.401	-0.172	0.219	-0.080	0.658	0.048	0.357
Personality factor												
Extraversion	0.202	0.345	0.071	0.409	-0.241	0.066	-0.019	0.894	0.003	0.989	-0.016	0.751
Agreeableness	0.166	0.118	0.124	0.146	0.235	0.073	0.257	0.063	0.027	0.883	0.173	0.001
Conscientiousness	0.197	0.063	0.188	0.026	0.107	0.421	0.362	0.008	-0.016	0.930	0.210	< 0.001
Emotional stability	0.072	0.502	-0.079	0.358	-0.188	0.154	-0.091	0.519	-0.320	0.074	-0.070	0.177
Intellect /imagination	0.256	0.016	0.083	0.331	0.014	0.915	0.202	0.146	-0.055	0.759	0.142	0.006

Table 7.2 Correlation of academic results with SDLR, age and personality

	Health Science (<i>n</i> = 92)	Sports and Exercise Science (<i>n</i> = 139)	Occupational Therapy (<i>n</i> = 61)	Physiotherapy (<i>n</i> = 53)	Podiatry (<i>n</i> = 33)	Total (<i>n</i> = 378)
Cohort, <i>mean</i> ± <i>SD</i>	68.27 ± 8.84 ^{ab}	69.68 ± 8.11 ^{cd}	76.93 ± 9.15 ^{ac}	78.85 ± 8.76 ^{bde}	73.12 ± 8.72 ^e	72.09 ± 9.45
Gender, <i>mean</i> ± <i>SD</i>						
Male	65.86 ± 9.06	68.25 ± 8.59	74.00 ± 10.79	76.59 ± 10.54	70.90 ± 8.68	69.87 ± 9.61
Female	68.99 ± 8.71	72.14 ± 6.59	77.25 ± 9.01	81.19 ± 5.73	76.54 ± 7.91	73.76 ± 9.00
Highest level of education, <i>mean</i> ± <i>SD</i>						
No previous / other qualification	68.67 ± 3.06	64.33 ± 8.45	#	-	-	66.10 ± 6.86
Complete secondary education	67.03 ± 8.20	69.47 ± 7.87	77.13 ± 9.39	79.34 ± 9.15	74.00 ± 7.36	72.12 ± 9.63
Incomplete vocational level studies	#	65.25 ± 8.85	-	-	-	62.80 ± 9.42
Complete vocational level studies	74.50 ± 8.28	71.48 ± 8.32	71.67 ± 7.53	#	66.25 ± 13.15	71.73 ± 8.59
Incomplete bachelor degree level studies	71.67 ± 9.30	70.80 ± 8.49	76.30 ± 7.26	76.00 ± 8.25	71.75 ± 7.70	72.54 ± 8.30
Complete bachelor degree level studies	72.40 ± 11.55	#	83.67 ± 8.08	79.00 ± 5.66	79.80 ± 7.46	77.94 ± 8.91
Unknown	57.50 ± 2.12	-	#	#	-	70.75 ± 17.78

Data not presented as only one respondent

- ^a Difference between health science and occupational therapy students was statistically significant ($p < 0.001$)
^b Difference between health science and physiotherapy students was statistically significant ($p < 0.001$)
^c difference between sports and exercise science and occupational therapy students was statistically significant ($p < 0.001$)
^d Difference between sports and exercise and physiotherapy students was statistically significant ($p < 0.001$)
^e Difference between physiotherapy and podiatry students was statistically significant ($p = 0.029$)

Table 7.3 Academic results by program and demographic factors

Variable	B	SE	β	<i>t</i>	<i>p</i>	Tolerance	VIF
(Constant)	55.061	4.895		11.249	< 0.001		
SDLR	0.014	0.026	0.038	0.551	0.582	0.455	2.199
Age	-0.035	0.115	-0.018	-0.306	0.760	0.611	1.637
Female	2.706	1.071	0.143	2.527	0.012	0.684	1.461
Highest level of previous education							
Incomplete vocational level studies	-5.196	3.877	-0.065	-1.340	0.181	0.944	1.059
Complete vocational level studies	0.537	1.667	0.018	0.322	0.747	0.070	1.414
Incomplete bachelor degree level studies	0.511	1.332	0.020	0.384	0.702	0.798	1.253
Complete bachelor degree level studies	4.310	2.506	0.094	1.720	0.086	0.729	1.372
Personality factor							
Extraversion	-0.083	0.083	-0.055	-1.003	0.317	0.717	1.394
Agreeableness	0.096	0.099	0.056	0.973	0.331	0.656	1.523
Conscientiousness	0.154	0.084	0.104	1.833	0.068	0.676	1.480
Emotional Stability	-0.085	0.060	-0.072	-1.415	0.158	0.840	1.191
Intellect / Imagination	0.135	0.101	0.082	1.339	0.182	0.581	1.720
Program							
Occupational Therapy	7.440	1.443	0.293	5.155	< 0.001	0.680	1.471
Physiotherapy	11.234	1.524	0.420	7.374	< 0.001	0.676	1.478
Podiatry	5.271	1.832	0.162	2.877	0.004	0.695	1.440
Sports and Exercise Science	3.607	1.234	0.185	2.924	0.004	0.545	1.836

Table 7.4 Multiple regression analysis of student's unit results

7.6 Discussion

This study investigated the relationship between SDLR and student academic performance, and compared with previously investigated demographic, educational and personality factors. The proxy for academic performance was students' final results in an interprofessional health sciences unit. SDLR and three of the 'Big Five' personality factors (conscientiousness, agreeableness, intellect/imagination) were positively correlated with student unit results. Gender was also associated with academic performance; females having higher results than males. There was also an association between academic performance and academic program. Students in physiotherapy had the highest unit results, and students in health sciences had the lowest unit results. The study also generated internal consistency reliability findings for each of the disciplines for the SDLRS (Guglielmino, 1978) and the 'Big Five' (Goldberg, 1992). Both instruments demonstrated good internal consistency across programs.

This study developed a model that predicted higher academic results. All factors were entered into the equation simultaneously using standard multiple regression. The regression model explained 25.9% of the variance, with only gender and discipline being predictive. These findings are congruent with other similar studies which have also conducted regression analyses to explain the variance in academic performance of students in the health disciplines. In occupational therapy literature, three studies had regression equations which accounted for 8.8% (Brown & Murdulo, 2017), 15.1% (Bonsaksen, 2016), and 16.4% (Bonsaksen & Ellingham, 2018) of the variance in academic performance of occupational therapy students. In medical literature, predictive models accounting for variance in academic performance ranged between 8.6% (Lucieer, Jonker, Visscher, Rikers, & Themmen, 2016) and 34.8% (Poole, Shulruf, Rudland, & Wilkinson, 2012). Thieman, Weddle, and Moore (2003) also conducted regression analyses. Age, GPA and GRE scores were significant their regression equation which explained 37.0% of the variance in academic performance of physical therapy students.

SDLR was investigated for association with academic performance, as a primary variable of interest. Across all students, a significant relationship was found between student unit results and SDLR, although with a small effect size ($r = 0.229$). This relationship, however, was not significant in independent analyses in each of the programs. Seemingly, this is due to smaller sample sizes in the programs investigated. This finding may explain the differences in the literature regarding the influence of SDLR on academic performance. Medicine and nursing traditionally have large cohorts, whereas programs in the allied health disciplines are much smaller. It is, therefore, important that future research in the allied health disciplines consider aggregating data. Research in interprofessional contexts can be an efficient way of doing this.

Conducting this study with students in an interprofessional health sciences subject provided the opportunity for comparison of findings across programs. Few studies have investigated the academic performance of students from different health disciplines; most studies occurring in single programs (e.g. Bonsaksen, 2016; Hay, 2016; Lancia, Petrucci, Giorgi, Dante, & Cifone, 2013; Patzer et al., 2017; Underwood, Williams, Lee, & Brunnert, 2013; Zipp, Ruscigno, & Olson, 2010). Studies involving both nursing and medical students have shown significant differences in academic performance across disciplines; medical students performing better (Salamonson, Everett, Koch, Wilson, & Davidson, 2009; Salamonson et al., 2013). In a study comparing allied health disciplines (occupational therapy, physical therapy, speech language pathology, rehabilitation counselling, and pharmacy), there were no differences across programs (Gonzalez, Hernandez, Coltrane, & Mancera, 2014). This differs from the results of the current study, which showed differences between disciplines. Students in physiotherapy, occupational therapy and podiatry had higher unit results than those in sports and exercise sciences and health science programs.

While not specifically investigated, a possible explanation for these differences might be that, under the Australian undergraduate admission system used by most universities, entry into different academic programs is determined using ranked academic scores, known as the Australian

Tertiary Admission Rank (ATAR). No other measure or selection criteria is used for the vast majority of students. Congruent with academic performance of students in the current study, the programs requiring the highest ATAR (physiotherapy and occupational therapy) had higher interprofessional unit results, and the program with the lowest minimum ATAR threshold (health science with the three majors) had, on average, lower unit results. Recently, Wurf and Croft-Piggin (2015) found ATAR to be a significant predictor of academic performance in the first year of undergraduate studies. Further research with first year undergraduate students should, therefore, include baseline academic performance measures such as standardized school-leavers' academic entry scores. This will then help determine whether it is the discipline or students' academic ability on entry that is the potent factor.

Gender also had a significant influence on student academic performance. Female students had higher unit results than male students. This finding is congruent with a number of other studies in the health disciplines (Edgar, Mercer, & Hamer, 2014; Hamaideh & Hamdan-Mansour, 2014; Hammond, 2009; Stegers-Jager, Themmen, Cohen-Schotanus, & Steyerberg, 2015; Wan Chik et al., 2012). Importantly, the gender association with academic performance was also found to be significant in multiple regression analysis ($p = 0.007$). It is, therefore, important that gender is included as a co-variate in future studies investigating student academic performance. Future studies might investigate associations between gender and academic ability on entry (e.g. ATAR scores), or whether there are curricular factors which influence gender differences in academic performance.

In the current study, age did not have a significant association with academic performance. In the literature, there are findings both indicative (Naylor, Norris, & Williams, 2014; Radke & Rideout, 2000; Salamonson et al., 2011; Wiest, Chumney, & Nappi, 2008), and not indicative (Bonsaksen, 2016; Edgar et al., 2014; Stegers-Jager et al., 2015; van Rooyen, Dixon, Dixon, & Wells, 2006) of an association between age and academic performance in cohorts of students in health professional programs. The variability in these studies, and the outcome of the current study, may

be influenced by a skewed age distribution given that the vast majority of students in undergraduate health professional programs are school-leavers, entering university immediately on completion of their secondary education. Interestingly, students who had previous higher education experiences performed better than school-leavers, which is congruent with previous studies (Bonsaksen, 2016; Dodds, Reid, Conn, Elliott, & McColl, 2010). This finding is particularly interesting as students who commenced or completed higher education studies would likely be older than students who only completed secondary education (mostly school-leavers). This is suggestive that engaging in prior post-secondary education study is an influential factor in student academic performance, rather than the passing of time/maturation as suggested by age. The reasons for this are unknown, however, they may relate to a range of factors such as the development of deep learning approaches predictive of academic performance (Salamonson et al., 2013), or motivation to succeed given the considered decision to return to study (Kenny, Kidd, Nankervis, & Connell, 2011). Further investigation of these factors is warranted.

This study also presents information which informs educators about the purpose and utility of SDLR. Regression analyses revealed that discipline and gender accounted for 25.9% of the variance in academic result. SDLR was not a statistically significant predictor in the modelling. This finding is useful for educators in determining the rationale for SDLR in first year curricula. The interprofessional unit in the study did not use an intentional educational approach that required or promoted self-directed learning. It would be interesting to explore the influence of SDLR on academic performance in units which anticipate or necessitate students to have skills in self-directed learning. These study findings suggest that the practical benefit of students' SDLR in first year is likely more related to intended professional practice competencies or participation in non-traditional teaching approaches, such as problem-based learning or distance education; rather than academic performance in individual subjects. Further exploration of these relationships will inform educator decision-making in curriculum design and appraisal of professional program accreditation requirements that currently require evidence of SDL development.

This study was the first to investigate the influence of personality on student academic performance for some of the disciplines investigated. There was a weak significant relationship between academic result and three of the personality factors: ‘conscientiousness’, ‘agreeableness’ and ‘intellect/imagination’, however, none of these factors were found to be predictive in the regression model. The influence of personality on academic performance has been investigated with occupational therapy and physiotherapy students, however, these have either used an instrument measuring other constructs of personality (Brown et al., 2016; Tan et al., 2004) or have investigated performance on clinical placement (Tickle-Degnen, 1998) or on a professional licensing examination (Galleher et al., 2012). Looking beyond disciplines of this study, the influence of personality on academic performance has been of interest in medical programs, and the factor ‘conscientiousness’ found to be predictive of academic performance with medical students (Doherty & Nugent, 2011). This is somewhat congruent with the findings from this study, where ‘conscientiousness’ had a significant association, however, was not predictive. This suggests it may be a proxy for something else which was accounted for in the regression. It is, therefore, important that future research investigating factors influencing academic performance includes personality traits for potential association.

7.6.1 Limitations

One limitation of this study was the grouping of students in the health sciences program. Students in this program could major in one of three disciplines: health promotion, health services management, or therapeutic recreation. Grouping students in these three disciplines together will, therefore, limit how these findings can be compared with other studies involving these disciplines.

Another limitation of the study was that student’s program admission entry scores were not included in the study. Academic program had a significant relationship with SDLR and was found to be significant in the regression equation accounting for variance in academic result. Given that students in programs requiring higher program admission entry scores had higher academic

results in the first-year interprofessional unit, it may be that academic program was a proxy for 'on entry' academic ability. Inclusion of students' individual program admission entry scores in this study would have allowed for better understanding of this relationship.

7.7 Conclusion

Academic performance in an interprofessional health sciences subject was associated with SDLR, gender, previous education, discipline and the personality factors 'conscientiousness', 'agreeableness' and 'intellect/imagination'. In regression analysis, however, only gender and discipline were significant predictors of SDLR which accounted for 25.9% of the variance. Students' SDLR was, however, not a significant predictor of academic performance in a first year interprofessional unit. Future research should explore the influence of SDLR on academic performance when traditional and intentional SDL promoting educational approaches are used. Future research may also focus on the influence of SDLR on attainment of professional practice competencies rather than performance in individual academic subjects.

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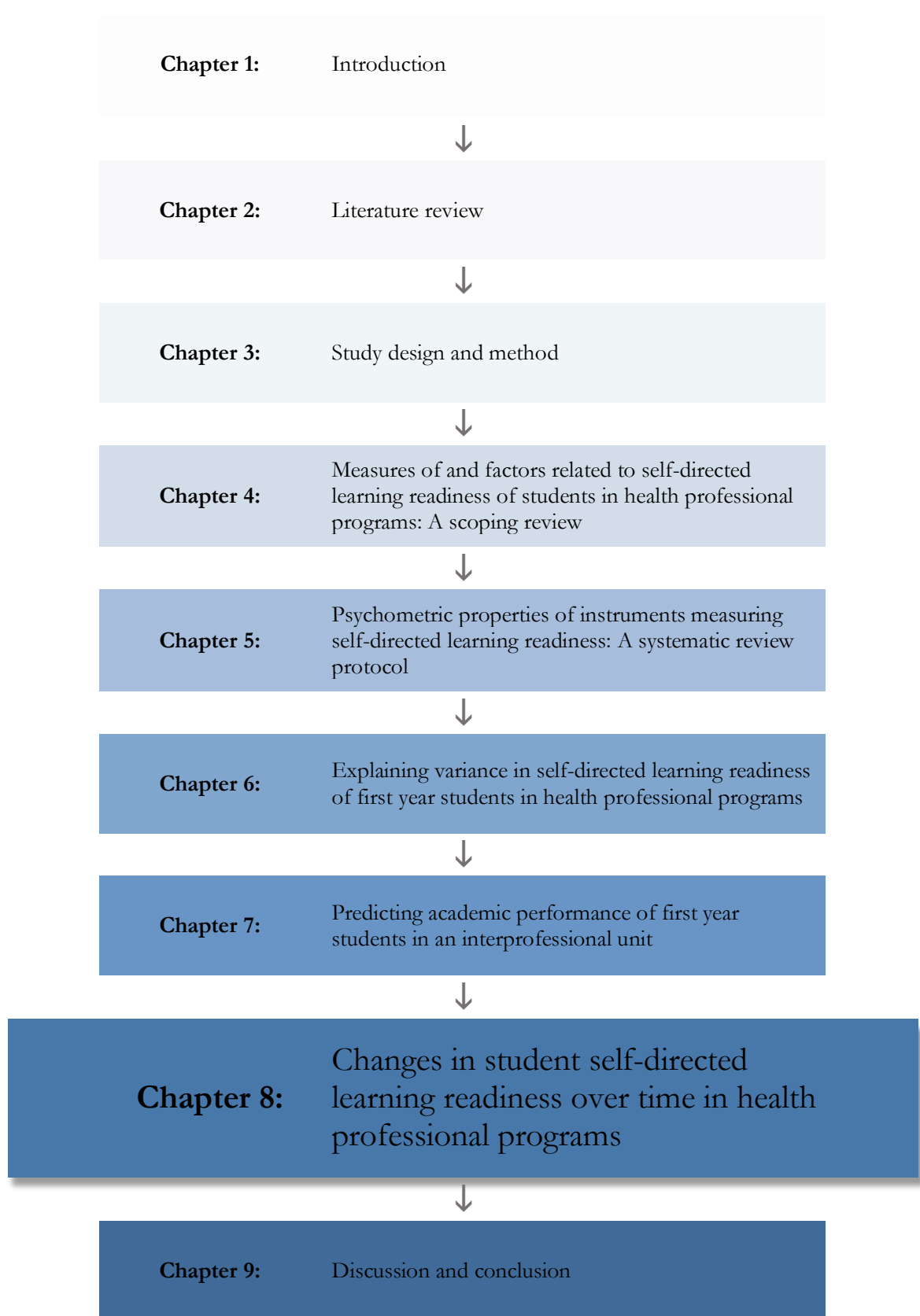


Figure 8.1 Thesis chapter progression: Chapter 8

Chapter 8

Changes in student self-directed learning readiness over time in health professional programs

This chapter is a manuscript which has been prepared for submission to the peer reviewed journal, *Journal of Allied Health*, for potential publication.

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Author Declaration:

The manuscript draft was prepared by the candidate Craig Slater, (CS) with supervision of Professor Anne Cusick (AC) and Dr Jimmy Louie (JL) as specified in the author contributions statement below.

Author Contribution statement:

CS led the study design, data collection, analysis, and drafting of the manuscript. AC participated in the study design, data collection, analysis, and drafting of the manuscript. JL participated in the analysis and drafting of the manuscript.

This chapter (author statement and preamble) was authored by CS under supervision feedback of AC and JL, with the manuscript prepared for submission to the *Journal of Allied Health* inserted after the preamble. Referencing, heading numbers and table numbers differ from the submitted manuscript in order to maintain formatting consistency throughout the PhD thesis.

8.1 Preamble

This chapter presents a longitudinal cohort study investigating changes in student SDLR over time. This chapter addresses *Research Objective 3: to determine students' SDLR over the duration of their program*. Chapter 6 presented the first known investigation of the influence of personality factors on student SDLR in the health disciplines. In response to literature proposing that SDL was a trait, Chapter 6 recommended that a longitudinal study was required to determine the stability of SDLR over time. This chapter (Chapter 8) is the actualization of this recommendation. The study also explores the influence of age, gender, previous education, program, GPA, and personality factors on changes in student SDLR, and as such addresses *Research Objective 1: to determine the factors which influence SDLR of students in health professional programs*. This study provides preliminary evidence relating to whether SDL is a trait, and provides recommendations for future research examining the nature of SDL, factors which require further investigation for potential influence on SDLR over time, and the professional utility of SDLR as a precursor for post-graduate self-directed, lifelong learning.

8.2 Abstract

Background: Accreditation standards often require health professional programs to develop students' readiness for self-directed, lifelong learning. Educators and researchers have consequently sought to determine whether students' self-directed learning readiness (SDLR) changes over time, and whether program efforts can influence a positive change. There has also been debate in the literature as to whether SDLR is a trait, and not amenable to instruction.

Method: A longitudinal cohort study was conducted to investigate: a) the change in SDLR over time in pre-certification students in health promotion, health services management, therapeutic recreation, sport and exercise sciences, occupational therapy, physiotherapy and podiatry programs; and b) the influence of demographic, educational and personality factors on these changes. The Self-Directed Learning Readiness Scale (SDLRS) and the 'Big Five' personality trait inventory was administered to 584 students in first year ($n = 312$ female). The same cohort of students was invited to voluntarily complete the SDLRS again in third year.

Results: Ninety-one students ($n = 65$ female) completed the surveys in both first year and third year. There was a significant decline in SDLR over time across the cohort. Changes in SDLR over time was associated with student GPA, and personality factors. Age, gender, and program, however, did not influence changes in SDLR over time.

Conclusion: The findings indicate that SDLR does change over time, is therefore not a trait, and may be an attitude amenable to instruction. Students' academic performance and personality traits, however, are correlated to change in SDLR over time and warrant further investigation. Since a goal of health professional programs is to prepare students for lifelong learning, an overall decline in SDLR runs counter to expected curriculum goals. There is a need for further investigation of how curricular, academic and personality factors influence SLDR over time to inform program efforts to meet accreditation standards.

Keywords: self-directed learning; students, health occupations; interdisciplinary studies.

8.3 Introduction

Preparing students to engage in autonomous, self-directed learning has been of particular concern in higher education settings, as evidenced by institutional graduate attribute statements (e.g. Western Sydney University, 2015). As such, educators have sought to understand students' readiness for self-directed learning on entry and how this changes over time; particularly that of school-leavers as they transition from pedagogical approaches to andragogical approaches. Wiley (1983) describes this self-directed learning readiness (SDLR) as "the degree [to which] the individual possesses the attitudes, abilities and personality characteristics for self-directed learning" (p. 182).

Students' SDLR over time has also been of interest to educators in the health disciplines, as accreditation requirements often require programs to develop students' attitudes and skills in self-directed, lifelong learning (e.g. Australian Medical Council, 2012; Australian Nursing &

Midwifery Accreditation Council, 2012; Occupational Therapy Council, 2013). While studies in the health disciplines mostly indicate that SDLR changes over time (Slater & Cusick, 2017), there is conflicting evidence of SDLR both increasing (Kocaman, Dicle, & Ugur, 2009; Malta, Dimeo, & Carey, 2010; Phillips, Turnbull, & He, 2015) and decreasing (Kell, 2006; O'Kell, 1988; Premkumar et al., 2013, 2014) in successive year levels. Other studies (Duman & Sen, 2012; Harvey, Rothman, & Frecker, 2003; Klunklin, Viseskul, Sripusanapan, & Turale, 2010; Yuan, Williams, Fang, & Pang, 2012) also found significant differences between year levels, however, not in a uniform direction. Given the differences in the literature, there is a need for further examination.

Different methods have been used to study students' SDLR over time in pre-certification health professional programs. Some have adopted a cross-sectional design to investigate students in different year levels (e.g. Harvey et al., 2003; Klunklin et al., 2010). Others have conducted longitudinal studies of student cohorts progressing through programs (e.g. Kell, 2006; Premkumar et al., 2013). While cross-sectional studies may present some indicative evidence of differences between year levels, they may also be ineffective for determining change over time as the sample differences between year levels may too influence differences in the dependent variable (Cohen, Manion, & Morrison, 2011). It is, therefore, important that changes in SDLR over time are investigated using a longitudinal cohort design.

In the literature, changes in student SDLR over time have been explained either developmentally with respect to the time students need to become independent learners (e.g. Phillips et al., 2015); or as a result of program influence (e.g. O'Kell, 1988). As such, investigating change in SDLR may serve two purposes: (i) to determine *when* students are most ready to engage in self-directed learning, or (ii) to determine if program efforts and educational approaches increase students' readiness for self-directed learning. There has also been discussion in the literature that SDLR may be relatively stable, and thus, an attribute or trait, rather than an attitude amenable to change (Lounsbury, Levy, Park, Gibson, & Smith, 2009).

Knowing whether SDLR is a trait or an attitude is important for programs, informing their curricular efforts to influence positive change. There is, therefore, a need for research enquiry to determine whether SDLR can be taught, and if so, how it should be taught, and when best to introduce it.

This study investigated changes in SDLR of students in pre-certification health professional programs over the first three years of their program. Age, gender, previous education, personality factors and academic performance were investigated for potential association with changes in SDLR. The study builds on previous research examining student SDLR over time, and provides a unique comparison of students across various programs. The study also adds to the debate in the existing literature as to whether SDLR is a personality trait, or whether SDLR can be influenced in pre-certification health professional programs. As aforementioned, the existing literature indicates that SDLR does change over time, however, there is conflicting evidence of SDLR increasing and decreasing with program progression. Therefore, drawing from adult learning theory (Knowles, 1978) which adopts a developmental understanding of SDL, the hypothesis for the current study was that student SDLR would increase over time.

8.4 Method

A longitudinal cohort design was used to investigate changes in student SDLR over time.

8.4.1 Participants

Participants of the study were enrolled in undergraduate, pre-certification health professional programs at a large metropolitan university in Sydney, Australia. There were 584 students ($n = 312$ female) who completed a series of surveys in an interprofessional health science in the first year, first semester of their program: health sciences (majors in therapeutic recreation, health promotion and health services management) ($n = 158$); sport and exercise science ($n = 215$); occupational therapy ($n = 86$); physiotherapy ($n = 71$); and podiatry ($n = 54$). These same students were invited to complete a survey in third year, second semester.

8.4.2 Study Procedure

Participants completed the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978) and the 'Big Five' personality traits inventory (Goldberg, 1992) in their first year, first semester. Students were able to indicate consent for use of their data in future research. There was an opportunity to re-administer the SDLRS to the same cohort of students in their third year, second semester. The 'Big Five' personality traits inventory was not re-administered given personality traits are widely considered to be stable over time (Roberts, Wood, & Caspi, 2008). In third year, students were invited via email to voluntarily participate in the follow-up survey. They were free to ignore the invitation, and thus, completion of the survey indicated tacit consent. Data from students who completed the surveys in both first year and third year were matched by a research assistant using student numbers. Institutional data, including student age, gender, program, previous education, and grade point average (GPA), were provided for use by the university, and matched to the student survey data. The dataset was then de-identified and provided to the researchers for analysis. The study protocol was approved by the Western Sydney University (H9857) and the University of Wollongong/Illawarra and Shoalhaven Local Health District (HE12/226) Human Research Ethics Committees.

8.4.3 Instruments

The SDLRS (Guglielmino, 1978) is the most commonly used instrument measuring SDLR with pre-certification students in health professional programs (Slater & Cusick, 2017). The instrument has 58 items which participants select one of five responses reflecting their preferences or attitudes to learning. Scores range from 58 to 290. Guglielmino and Associates (n.d) report a mean of 214 ± 25.6 in an adult population. This instrument has been used with cohorts of physiotherapy (Kell, 2006; Kell & van Deursen, 2000, 2002, 2003; Kell, 2007; Mori, Batty, & Brooks, 2008) and occupational therapy (Linares, 1999; Malta et al., 2010) students. Slater, Cusick, and Louie (2017b) found good internal consistency of Cronbach's $\alpha = 0.93$.

The 'Big Five' personality inventory (Goldberg, 1992) is a measure of the following five personality factors: 'extraversion', 'agreeableness', 'conscientiousness', 'emotional stability' and 'intellect/imagination'. As per the International Personality Item Pool (IPIP) website (<http://ipip.ori.org/>), there are 50 items in the inventory, to which participants select one of five responses which best describes themselves. Scores range from 10 to 25 for each of the five factors. This instrument was found to be valid and reliable with an undergraduate student cohorts (Gow, Whiteman, Pattie, & Deary, 2005). Slater et al. (2017b) found good internal consistency of Cronbach's $\alpha = 0.87$.

8.4.4 Data Analysis

Data was entered into SPSS™ version 22.0 (IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics were used to characterize the sample. Paired t-tests were used in the analysis of SDLRS score changes over time. Mixed between-within subjects ANOVAs were conducted to determine differences in SDLR change over time between groups. Pearson's correlation was used to investigate relationships between the change in SDLRS scores over time and continuous variables (age, personality and GPA).

This study was a longitudinal observational study, and no interventions were investigated. The study was initially conducted in May 2010 as a cross-sectional study, however, there was an opportunity to re-administer instruments in October 2012 with a convenience sample. As such a power analysis was not conducted apriori to determine sample size. The results of this study, however, may be used to inform power and sample size calculations for future studies investigating student SDLR over time; in particular when estimating the effect size.

8.5 Results

8.5.1 Characteristics of the sample

Ninety-one students completed both the first year and third year surveys. As shown in *Table 8.1*, there was representation in the sample from each of the five programs, however, students in

sport and exercise science ($n = 6$) only accounted for 6.6%. There were significantly more females ($n = 65$) than males ($n = 26$), $\chi^2(4) = 17.81$, $p < 0.001$. Most students (63%) had completed secondary education as their highest level of previous education. A third had previously commenced or completed a tertiary program (vocational level or bachelor's degree level). The mean age on entry into the program was 21 years. There were no significant differences across disciplines with respect to age or personality traits. There were significant differences in GPA across programs on a seven-point GPA scale, $F(4,86) = 7.413$, $p < 0.001$.

8.5.2 SDLR over time

Across the cohort, there was an overall decline in student SDLR over time. As shown in *Table 8.2*, SDLRS scores were significantly lower in third year (199.44 ± 13.85) than in first year (215.59 ± 24.27), $t(90) = 6.83$, $p < 0.001$. Student SDLR declined in all programs, with the exception of sport and exercise sciences ($n = 6$). SDLR also declined over time for both males and females, as well as for students who had completed secondary education, and either commenced or completed a tertiary program. Mixed between-within subjects ANOVAs revealed no significant differences in SDLR decline by program, gender or prior education.

Change in SDLR was associated with GPA and four of the 'Big Five' personality factors. In the whole cohort, SDLRS score difference (2010 score – 2012 score) had a weak negative correlation with GPA ($r = -0.247$, $p = 0.018$) indicating that students with lower GPAs had greater changes in SDLRS scores. There was a moderate negative correlation with the personality factors: 'emotional stability' ($r = -0.312$, $p = 0.003$), 'agreeableness' ($r = -0.356$, $p = 0.001$), 'conscientiousness' ($r = -0.407$, $p < 0.001$), and 'intellect/imagination' ($r = -0.455$, $p < 0.001$). Students who scored lower on these four personality factors also had greater changes in SDLRS scores over time.

	Health Science	Sport and Exercise Science	Occupational Therapy	Physiotherapy	Podiatry	Cohort
<i>n (%)</i>	23 (25.3)	6 (6.6)	20 (22.0)	25 (27.5)	17 (18.7)	91 (100)
Gender, <i>n (%)</i>						
Male	3 (13.0)	3 (50.0)	1 (5.0)	9 (36.0)	10 (58.8)	26 (28.6)
Female	20 (87.0)	3 (50.0)	19 (95.0)	16 (64.0)	7 (41.2)	65 (71.4)
Age at baseline, <i>mean years ± SD</i>	20.04 ± 4.31	27.33 ± 12.68	21.25 ± 7.30	19.68 ± 5.62	21.29 ± 5.74	20.92 ± 6.51
Previous level of education, <i>n (%)</i>						
Complete secondary education	16 (69.6)	2 (33.3)	12 (60.0)	19 (76.0)	9 (52.9)	58 (63.7)
Complete or incomplete tertiary program	5 (21.7)	4 (66.7)	8 (40.0)	5 (20.0)	8 (47.1)	30 (33.0)
No / other / unknown qualification	2 (8.7)	-	-	1 (4.0)	-	3 (3.3)
Personality trait, <i>mean ± SD</i>						
Extraversion	33.65 ± 6.73	34.00 ± 5.33	33.26 ± 7.13	32.56 ± 5.34	34.59 ± 7.71	33.47 ± 6.48
Agreeableness	42.78 ± 4.13	39.67 ± 8.09	43.53 ± 4.26	41.28 ± 4.58	40.41 ± 6.13	41.87 ± 5.06
Conscientiousness	35.00 ± 6.45	30.67 ± 3.39	38.42 ± 7.14	37.08 ± 6.59	35.29 ± 5.82	36.07 ± 6.55
Emotional stability	31.83 ± 8.13	30.33 ± 4.23	33.11 ± 6.85	31.44 ± 8.12	31.71 ± 6.72	31.87 ± 7.30
Intellect/imagination	34.52 ± 6.03	32.33 ± 4.37	37.53 ± 4.87	36.08 ± 6.44	35.53 ± 7.28	35.63 ± 6.12
GPA, <i>mean ± SD</i>	4.57 ± 0.58*	4.96 ± 0.73	5.16 ± 0.74	5.64 ± 0.66*	5.18 ± 0.76	5.13 ± 0.77

* Difference between health science and physiotherapy was statistically significant ($p < 0.001$)

Table 8.1 Characteristics of sample

Variable	<i>n</i>	SDIRS score, <i>mean</i> ± <i>SD</i>		Score difference,		95% CI for mean difference	<i>t</i>	<i>df</i>	<i>p</i>
		2010	2012	<i>mean</i>					
Cohort	91	215.59 ± 24.27	199.44 ± 13.85	- 16.15		11.45, 20.85	6.83	90	<0.001
Program									
Health Science	23	207.96 ± 20.32	195.00 ± 13.28	- 12.96		3.92, 21.99	2.97	22	0.007
Sport and Exercise Science	6	196.33 ± 34.02	199.50 ± 20.68	3.17		-32.15, 25.81	-0.28	5	0.790
Occupational Therapy	20	225.15 ± 20.59	198.35 ± 7.07	- 26.8		16.91, 36.69	5.67	19	<0.001
Physiotherapy	25	218.96 ± 25.27	202.48 ± 15.22	- 16.05		7.89, 25.07	3.96	24	0.001
Podiatry	17	216.53 ± 23.84	202.24 ± 15.60	- 14.29		2.28, 26.31	2.52	16	0.023
Gender									
Male	26	212.42 ± 25.29	201.00 ± 16.75	- 11.42		2.59, 20.26	2.66	25	0.013
Female	65	216.86 ± 23.94	198.82 ± 12.60	- 18.04		12.41, 23.68	6.40	64	<0.001
Previous level of education									
Complete secondary education	58	211.48 ± 22.82	197.19 ± 12.75	- 14.29		8.73, 19.86	5.15	57	<0.001
Complete or incomplete tertiary program	30	222.73 ± 26.37	202.87 ± 13.74	- 19.86		10.42, 29.31	4.30	29	<0.001
No / other / unknown qualification	3	223.67 ± 15.50	208.67 ± 28.54	- 15.00		-45.24, 75.24	1.07	2	0.396

Table 8.2 Self-directed learning readiness over time

Variable	Cohort	
	<i>r</i>	<i>p</i>
Age	- 0.073	0.492
GPA	- 0.247	0.018
Personality factors		
Extraversion	- 0.044	0.677
Agreeableness	- 0.356	0.001
Conscientiousness	- 0.407	< 0.001
Emotional stability	- 0.312	0.003
Intellect /imagination	- 0.455	< 0.001

Table 8.3 Correlation between change in SDLR score and age, GPA and personality

8.6 Discussion

This study investigated changes in students' SDLR over the first three years of their program. Age on entry to the program, gender, previous education, program, academic performance and personality factors were also investigated for potential influence on changes in SDLR. Across the whole cohort, there was an overall decline in student SDLR. The decline was observed in students across all levels of previous education, and in both males and females. These findings are congruent with several other longitudinal studies (Kell, 2006; Premkumar et al., 2013, 2014). There was also a decline in SDLR in each of the disciplines except sports and exercise sciences ($n = 6$). There were no discernable differences between programs to warrant interrogation of program attribute through additional study. This is a need, however, for future studies to investigate the reasons for student SDLR decline over time. Potentially, it may be the curriculum that influences student SDLR decline. In programs employing traditional teaching and learning methods, the curriculum may not require students to be self-directed in their learning, and students, therefore, may become dependent on their teachers to facilitate their learning. Another reason for student SDLR decline is that student may have experienced a shift in focus over time. In first year, it is plausible that their focus was on engaging with curricular

teaching and learning activities; however, in their third year, the focus may have been on entering the workforce given that these students were either one month (health sciences, and sports and exercise science programs) or one year (occupational therapy, physiotherapy, and podiatry programs) out from completing their respective program. This requires further investigation.

The change in student SDLRS score between the two points in time, however, was correlated to personality factors. A greater decline in SDLR between first year, first semester and third year, second semester was observed in students who scored lower on the personality factors: 'agreeableness', 'conscientiousness', 'emotional stability', and 'intellect/imagination'. This is a new finding in the literature given no other longitudinal study involving students in the health disciplines has investigated changes in SDLR for association with personality traits. It is interesting that in this study all of the 'Big Five' personality factors except for 'extraversion' had an association with change in SDLRS scores. It may not be surprising that the personality factors 'conscientiousness' and 'intellect/imagination' had associations with SDLR change given they encompass traits which may appear to foster SDLR, such as taking initiative, being responsible and being independent-minded. While the other two personality factors ('agreeableness' and 'emotional stability') may appear to have less relevance to student SDLR, from this study it is evident that there is a relationship with SDLR which requires further exploration in future studies. In the health disciplines, there is only one known study (Slater, Cusick, & Louie, 2017a) which has investigated the influence of personality on SDLR; however, the study had a cross-sectional design and did not investigate changes in SDLR over time. The study did find associations between each of the 'Big Five' personality factors and SDLR. Similar to the current study, 'intellect/imagination' had the strongest correlation with SDLR out of the 'Big Five' factors, followed by 'conscientious' and 'agreeableness'. Further investigation is also needed to determine whether these changes in student SDLR can be mediated through targeted program instructional efforts.

The current study also found a correlation between GPA and change in SDLR. This a new finding in the literature given that no other longitudinal study involving students in the health disciplines has investigated changes in SDLR for association with academic performance. In the literature, cross-sectional studies (Alotaibi, 2016; Linares, 1999) have found significant positive correlations between SDLR and GPA; however, these studies did not investigate changes in SDLR over time. Other studies have investigated the relationship between SDLR at one point in time and other proxies for academic performance. These studies have also found relationships between SDLR and course results (Davis & Pearson, 1996), and between SDLR and performance on clinical clerkships (Shokar, Shokar, Romero, & Bulik, 2002). It is apparent from the current study, and the existing literature that academic performance likely has a relationship with both SDLR, and changes in SDLR over time which warrants further investigation.

This study adds to the debate whether self-directed learning is a trait, as proposed by Lounsbury et al. (2009), or whether it can change over time. Traits are considered to be individual characteristics which are relatively stable over time (Roberts et al., 2008). This was not the case for student SDLR, for which there was a significant decline observed across the whole cohort. It is apparent that SDLR does change and, therefore, self-directed learning is not an individual trait. The findings also appear to not support a developmental perspective of self-directed learning, such as Knowles' (1978) adult learning theory, as SDLR would have been expected to increase with maturation. Further investigation of participants as they transition from 'early adulthood' to 'adulthood' life phases would be useful to further explore this proposition.

The programs investigated in the study each employed traditional teaching and learning methods (i.e. mostly didactic lecture and tutorials). Students in all programs completed seven common interdisciplinary units together, except sports and exercise sciences which were involved in five. There were many other units which involved students in three or more programs. While students studied in different programs, given the number of units taken

together, they had similar learning experiences. This may account for similar changes in SDLR across all programs. In the literature, there is other evidence of student SDLR decreasing over time in programs implementing mostly traditional curricular approaches (O'Kell, 1988; Premkumar et al., 2013, 2014). As such, traditional teaching and learning methods may not be effective in developing students' attitudes and skills for self-directed learning, and targeted self-directed learning approaches may be warranted. This requires further research.

Many health professional programs have employed educational approaches which either necessitate or anticipate higher degrees of self-directed learning, often in a deliberate attempt to prepare students for self-directed, lifelong learning. Such approaches have included problem-based learning (PBL), online learning, team-based learning, flipped classrooms or targeted self-directed learning activities. Of these, PBL has received much attention in the literature. Several longitudinal studies (Duman & Sen, 2012; Kocaman et al., 2009; Malta et al., 2010; Tsou et al., 2009) have found increases in SDLR over the duration of PBL curricula. To date, few studies have compared the effect of a PBL versus a traditional curriculum on student SDLR. Kell and van Deursen (2002) compared the effect of 'teacher-led' and 'problem-solving' curricula, however there were no significant differences between the two. There is a need for future research to firstly determine whether SDLR is amenable to instruction, and if so, which method of instruction is most effective in increasing SDLR over time.

The findings from this study have implications for both programs and universities, in demonstrating students' development of self-directed, lifelong learning skills and attitudes for accreditation or meeting graduate attribute objectives respectively. It cannot be assumed that student SDLR will increase purely through exposure to traditional curricula, or student maturation. It appears that a targeted approach to developing these attitudes and skills may be necessary to effect a positive change on student SDLR. Importantly, for professional practice, further research inquiry is needed to determine whether increasing or declining student SDLR influences post-graduate professional attitudes and practices in maintaining knowledge and skill

currency; particularly with regards to continuing professional development, evidence-based practice, and reflective practice.

8.6.1 Limitations

Only 91 students completed surveys in both first year and third year; a response rate of 15.6%. This low follow-up occurred as first year data was initially collected as a single cross-sectional study. In year three, there was an opportunity to re-administer the survey with the same cohort and, therefore, collect longitudinal data. Students voluntarily participated in the third-year survey in the final four weeks of the semester – the final semester for students in the health science and sport and exercise programs. The low response rate might be explained by the timing of the follow-up survey, which was (a) during a peak student assessment period where students may have prioritized coursework over voluntary activities, and (b) in the final weeks of the program for health science and sport and exercise science students, when motivation to participate in extra-curricular activities might be lower. Further investigation of SDLR over time should adopt a longitudinal cohort design from inception and utilize strategies to minimize participant attrition, particularly with regards to timing of survey administration.

While there was low follow-up with the third-year survey, however, this study is the second largest longitudinal study of SDLR involving students from allied health disciplines following Kell (2006) ($n = 123$). As such, these findings present an important addition to the evidence base informing curricular teaching and learning approaches.

8.7 Conclusion

There was an overall decline in student SDLR over the first three years of their program. There were no differences observed between programs, or by gender or prior educational experiences. Changes in SDLR over time were, however, negatively associated with student GPA and four personality factors. A greater decline in SDLR was observed in students who had a lower GPA

and scored lower in the personality factors: agreeableness, conscientiousness, emotional stability and intellect/imagination. The fact that SDLR did change over time was also important, as it indicates that self-directed learning is not a trait, which is relatively stable, but rather, it is influenced by one or more factors. These findings inform future research efforts to further investigate whether curricular approaches can mediate the influence academic and personality factors; and if so, which approach is most effective in developing SDLR. Importantly, for professional practice, there is also a need for further longitudinal study to determine whether changes in student SDLR influence post-graduate professional attitudes and practices in maintaining knowledge and skill currency.

8.8 References

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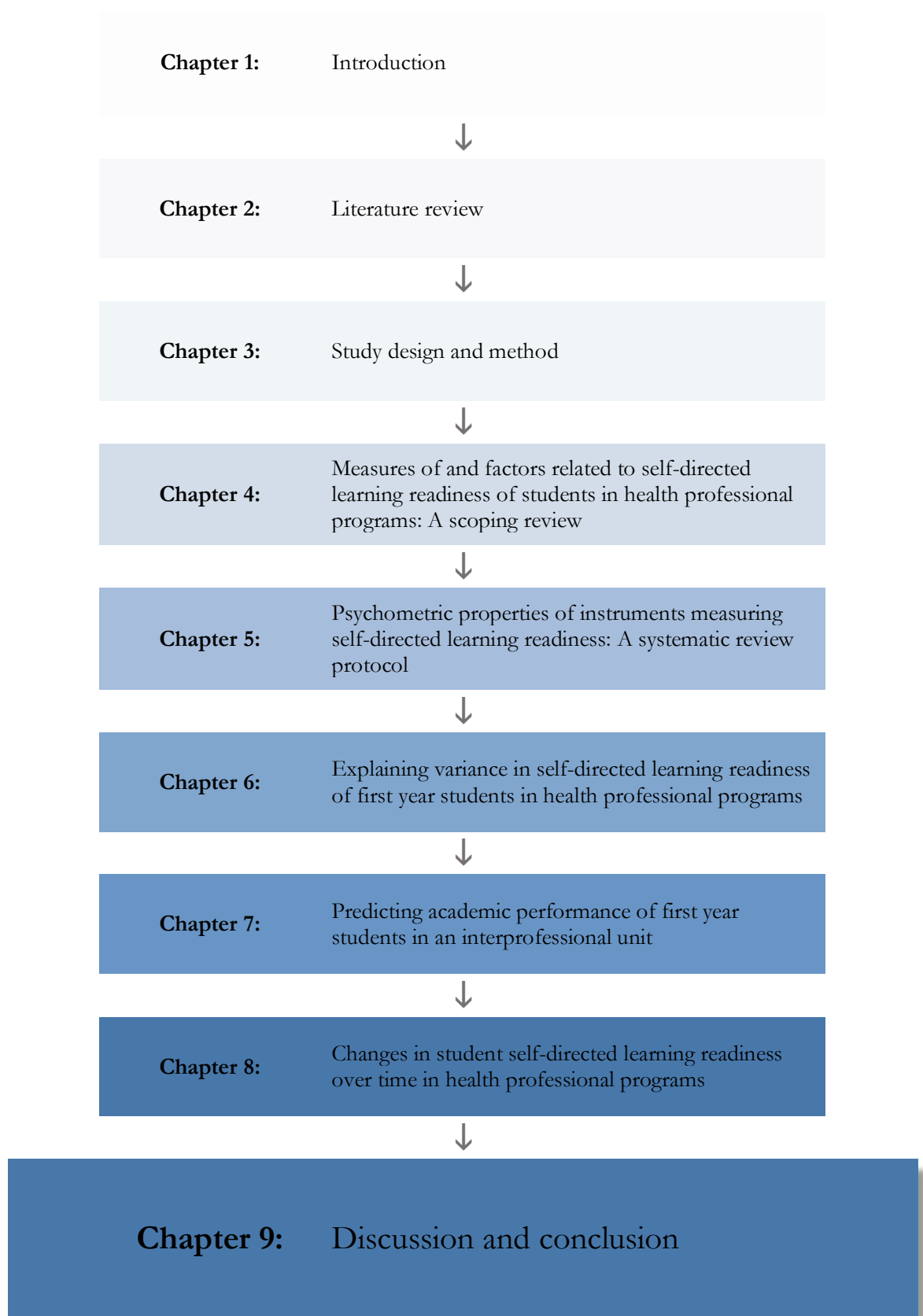


Figure 9.1 Thesis chapter progression: Chapter 9

Chapter 9

Discussion and Conclusion

9.1 Preamble

This thesis was presented as a ‘thesis by compilation’, in accordance with the rules set out by the University of Wollongong (2017). In this study series, there are two papers which have been published in the peer-reviewed journals, *Nurse Education Today* (Chapter 4), and *BMC Medical Education* (Chapter 6); one manuscript which has been submitted to the journal, *Systematic Reviews*, for peer review (Chapter 5); and two ‘in-draft’ manuscripts ready for submission to relevant journals for peer-review, (Chapters 7 and 8). Each of the five study chapters presented a discussion of the findings in the context of the literature. This final chapter of the thesis will, therefore, present (i) a summary of the findings in the context of the study objectives and research questions; (ii) discussion of the findings with regards to the theoretical frames of reference; (iii) an appraisal of the strengths and limitations of the study series; and finally (iv) discussion of the study implications for educational programs, research, and policy. The chapter will close with a conclusion of the study series.

9.2 Summary of findings

Through the series of five studies, this PhD study series has met the overarching aim: *to explore the SDLR of students in health professional preparation programs to inform teaching and learning approaches*. The findings from this research have met a gap in the literature about SDLR: the factors influencing it, how it is measured, its utility for programs, and its stability over time. This provides a comprehensive understanding of SDLR which is useful for informing program teaching and learning approaches. Through the study series, each of the four research objectives were met. A summary of the findings is presented below. The findings are organised under relevant study objectives and research questions to demonstrate how each objective was met.

9.2.1 Objective 1:

To determine the factors which influence SDLR of students in health professional programs.

Which factors have been investigated for potential association with SDLR?

Chapter 4 Twenty-one potential determinants have been investigated for association with student SDLR with pre-certification students in the health disciplines. Included studies investigated a range of demographic, educational, discipline, academic and professional factors. The most common factors investigated were gender (34.7%), year level (34.7%), age (32.7%), program delivery (32.7%), and previous education (22.4%).

Which factors have a significant relationship with SDLR of students in health professional program?

Chapter 4 There is nascent evidence that year level, age and previous tertiary education has influence on SDLR of students in health professional programs. Among the identified studies, eleven found significant differences in student SDLR between year levels; studies mostly found SDLR increasing with program progression. Six studies found that increasing age positively influenced SDLR. Another four studies found that students who had higher levels of prior education on entry into programs had higher SDLR. It was observed that year level, age and previous education have in common the passing of time. It was discussed that these factors may be proxy for a more encompassing construct such as individual cognitive or social development, or individual occupational socialization to the discipline or the health field in general.

Chapter 6 In a cross-sectional study of students in first year, first semester significant relationships were found between SDLR and gender, age, previous education, discipline, and each of the 'Big Five' personality traits.

- Females had higher SDLR than males.
- SDLR increased with age.
- Students who had previous higher education experience had higher SDLR.
- Students in occupational therapy had the highest SDLR and students in health science had the lowest SDLR.
- SDLR had a weak positive correlation with 'emotional stability'; a moderate positive correlation with 'agreeableness' and 'conscientiousness'; and a strong correlation with 'intellect/imagination'.

In the regression analysis, personality factors ('intellect/imagination', 'conscientiousness' and 'agreeableness'), previous post-secondary education and program (occupational therapy, physiotherapy and podiatry) were significant and accounted for 52.9% of the variance in SDLR.

9.2.2 Objective 2:

To explore the attributes of instruments used to measure SDLR of students in health professional programs.

Which instruments have been used to measure student SDLR in health professional programs?

Chapter 4 Six instruments have been used to measure SDLR of students in health professional programs: the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978), Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher, King, & Tague, 2001), Competencies of Self-Directed Learning (Knowles, 1975), Oddi's Continuing Learning Inventory (OCLI) (Oddi, 1986), Ryan's two part self-assessment (Ryan, 1993), and the Self-Directed Learning Inventory (SDLI) (Cheng, Kuo, Lin, & Lee-Hsieh, 2010).

The vast majority of studies used either the SDLRS (49 %) or the SDLRSNE (43%). Only the SDLRS has been used in studies involving students in allied health programs (occupational therapy and physical therapy/physiotherapy).

What are the characteristics of instruments used to measure SDLR of students in health professional programs?

Chapter 5

The SDLRS (Guglielmino, 1978) is a 58-item instrument which uses a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). It was developed using Delphi survey with expert researchers in 'self-direction' and was piloted in an adult population (graduate students, administrators, adult education specialists, and home makers) and then again in a student population (high school, undergraduate and adult education).

The SDLRSNE (Fisher et al., 2001) is a 40-item instrument which uses a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The instrument has three subscales (self-management, desire for learning, self-control). It was developed using Delphi survey with expert nurse academics and nurse educators. It was piloted in an undergraduate nursing student population.

The OCLI (Oddi, 1986) is a 24-item instrument which uses a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). It was developed using content validation with graduate students (law, education and nursing), and experts in education and psychology. It was piloted with graduate students in law, education and nursing.

The SDLI (Cheng et al., 2010) is a 20-item instrument which uses a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). It has four domains (learning motivation, planning and implementation, self-monitoring, interpersonal communication). It was developed using Delphi study with

experts in adult/higher education and nursing education. It was piloted in an undergraduate nursing student population.

Ryan's (1993) two-part self-assessment has four items which are completed twice; 'perceived importance', and then 'perceived ability'. It uses a seven-point scale (0 = absent, 6 = high). The items are taken from the Competencies of SDL (Knowles, 1975). It was tested in an undergraduate nursing student population.

The Competencies of SDL (Knowles, 1975) was developed as a learning resource, but has been used as an instrument with graduate-entry medical students (Elzubeir, 2009). It has nine items and uses a four-point ordinal scale (none, weak, fair, strong).

What are the psychometric properties of instruments used to measure SDLR of students in health professional programs?

Chapter 3 Guglielmino and Guglielmino (1991) reported the SDLRS to have a split-half reliability of $r = 0.94$. Test-retest reliability has also been reports as $r = 0.79$ (Wiley, 1983) and $r = 0.82$ (Finestone, 1984). There has been support (Delahaye & Smith, 1995; Finestone, 1984; Torrance & Mourad, 1978) and criticism (Bonham, 1991; Brockett, 1985; Hoban, Lawson, Mazmanian, Best, & Seibel, 2005) of the instruments' construct validity.

Chapter 5 A protocol for a systematic review to further investigate the psychometric properties of instruments measuring SDLR has been developed.

Chapter 7 In a cohort of first year, first semester students in health professional programs, the SDLRS demonstrated very good internal consistency with

Cronbach's $\alpha = 0.93$ in the whole cohort, and between $\alpha = 0.91$ and $\alpha = 0.94$ across individual programs.

9.2.3 Objective 3:

To determine students' SDLR over the duration of their program

How ready are students for SDLR on entry into health professional programs?

Chapter 6 In a cross-sectional study of students in first year, first semester, the mean SDLRS score was 212.74 ± 24.68 . Across programs, mean SDLRS scores were 209.47 ± 27.21 in health science, 207.51 ± 22.66 in sports and exercise science, 220.29 ± 24.86 in occupational therapy, 219.23 ± 22.40 in physiotherapy, and 217.40 ± 23.26 in podiatry. According to the score interpretation ranges for the SDLRS (Guglielmino and Associates, n.d), the mean score in the cohort, as well as the mean scores in each of the programs were within the 'average' range (202 – 226).

Does student SDLR change over time?

Chapter 8 In a longitudinal cohort study, SDLR of students in health professional programs significantly declined between first year, first semester (215.59 ± 24.27) and third year, second semester (199.44 ± 13.85), $p < 0.001$. A significant decline in SDLR was observed in all programs except for sports and exercise science ($n = 6$). The mean SDLRS scores in third year, second semester for the whole cohort, and also in health science (195.00 ± 13.28), sport and exercise science (199.50 ± 20.68), and occupational therapy (198.35 ± 7.07) programs were in the 'below average' range (58 – 201) (Guglielmino and Associates, n.d). Mean SDLRS scores in physiotherapy (202.48 ± 15.22) and podiatry (202.24 ± 15.60) programs were at the lower threshold for the 'average' range (202 – 226).

Which factors influence SDLR change over time?

Chapter 8 There was a general decline in SDLR across the whole cohort. There were no differences found in SDLR decline by program, gender or previous education. Decline in SDLR, however, was negatively correlated with grade point average and four personality factors: ‘agreeableness’, ‘conscientiousness’, ‘emotional stability’ and ‘intellect/imagination’.

9.2.4 Objective 4:

To determine the influence of student SDLR on academic performance.

Does student SDLR influence academic performance?

Chapter 7 Student SDLR, measured early in first year, first semester had a significant relationship with student end-of-semester results (scored out of 100) in an interprofessional health sciences unit in the same semester. Academic result increased with SDLR. This relationship, however, was not significant in independent analyses in each of the programs. It was suggested these differing findings may be in part due to smaller sample sizes in the programs investigated. In regression analysis, SDLR was not predictive of academic performance in the unit.

9.3 Application to theoretical frames of reference

Three theoretical perspectives of SDL were presented in the literature review (*Chapter 2*): Adult Learning Theory (Knowles, 1978), the Personal Responsibility Orientation (PRO) Model (Brockett & Hiemstra, 1991), and the Self-Directed Learning Model (Garrison, 1997). Each of the models acknowledged various internal and external aspects of SDL, however, there were differences between the models, particularly in relation to developmental understandings of SDL (Knowles, 1978), the influence of personality factors (Brockett & Hiemstra, 1991), and the importance of motivation for commencing and maintaining SDL (Garrison, 1997).

9.3.1 Developmental influences on SDLR

The study series was able to explore developmental influences on SDL by investigating age as a potential determinant of SDLR, and by conducting a longitudinal study over nearly three years. Adopting a developmental perspective of SDL, it would be expected that older students would be more ready for SDL than younger students, and that over time there would be an increase in SDLR as individuals mature.

In *Chapter 4* of this thesis, it was identified that there was nascent evidence in the literature to suggest that increasing age was associated with SDLR. Similarly, in *Chapter 6*, the cross-sectional study of students in first year, first semester found that increasing age was not only associated, but it was significant in the regression model explaining part of the variance in SDLR. In *Chapter 8*, however, there was a significant decline in SDLR across all students between first year, first semester and third year, second semester. Also, age did not influence decline in SDLR over time. These findings show that age is an important factor influencing SDLR early in programs, however, they suggest that there are more potent factors influencing SDLR across the duration of programs.

A developmental understanding of SDL, such as Knowles (1978) goes some way, but does not fully explain students' SDLR, particularly over time. In considering application of Knowles' (1978) Adult Learning Theory, however, it is important to note that the theory does not attempt to explain all the factors influencing SDL. It provides only a description of the characteristics of pedagogy and andragogy, and other than suggesting that SDL increases as individuals mature, it does not provide a process of interacting components leading to SDL, like the other two models presented.

9.3.2 Personality influences on SDLR

This study series included the first known study to investigate the influence of personality on SDLR in a cohort of students in health professional programs (*Chapter 6*). In the PRO model

(Brockett & Hiemstra, 1991), the ‘learner self-direction’ dimension reflects the learner’s personality characteristics which may predispose individuals to engaging in SDL. The study series was, therefore, able to explore the relationship between the ‘learner self-direction’ and the ‘self-direction in learning’ dimensions of the model.

In *Chapter 6*, it was found that all of the ‘Big Five’ personality factors (Goldberg, 1992) influenced student SDLR: ‘intellect/imagination’ ($p < 0.001$), ‘conscientiousness’ ($p < 0.001$), ‘agreeableness’ ($p < 0.001$), ‘extraversion’ ($p < 0.001$), and ‘emotional stability’ ($p = 0.001$). In the regression analysis, only ‘intellect/imagination’ ($p < 0.001$), ‘conscientiousness’ ($p < 0.001$), ‘agreeableness’ ($p < 0.001$) were significant in accounting for part of the variance. As discussed in *Chapter 2* (Section 2.4.1), SDL relates to processes where learners take initiative for their own learning, and independently plan, implement and evaluate their learning approaches. It is, therefore, not surprising that the factors ‘conscientiousness’ and ‘intellect/imagination’ had association with SDLR given that these factors encompass traits such as being organized and planful (‘conscientiousness’); and being insightful and independent-minded (‘intellect/imagination’). Assertiveness, a trait of ‘extraversion’, may also be important in the initiation of SDL and may potentially explain the association between ‘extraversion’ and SDLR found in this study. Inductively, however, the other two personality factors (‘agreeableness’ and ‘emotional stability’) appear to have less relevance to SDL as these factors encompass traits such as being kind and affectionate (‘agreeableness’); and being calm and not easily upset (‘emotional stability’).

While the study series did not attempt to validate the PRO model in entirety, these findings support the relationship between the ‘learner self-direction’ and the ‘self-direction in learning’ dimensions of the model. As this was the first study to explore the influence of personality on SDLR among pre-certification students in health professional programs, further studies including personality as a potential determinant are needed and researchers should consider a study design which can investigate the relationships between all dimensions of the PRO model.

9.3.3 Motivational influences on SDLR

This study series did not investigate motivation as a potential determinant of SDLR, and therefore, has limited application to the Self-Directed Learning Model (Garrison, 1997). Future studies attempting to explore the utility Self-Directed Learning Model should investigate motivation and approaches to study (cognitive dimension of learning) for potential association with SDL.

9.4 Study strengths

While the strengths of individual studies were presented in respective chapters, there were several strengths of the collective study series.

9.4.1 Efficient collection of data from multiple disciplines

Chapter 4 identified that investigation of student SDLR in the health disciplines had mostly occurred in medical and nursing contexts (Slater & Cusick, 2017). Several studies had involved students in pharmacy, physiotherapy and occupational therapy programs, however, only few. For many other health disciplines, both clinical and non-clinical, student SDLR had never been investigated, despite the program accreditation, professional society and professional registration drivers for students to develop self-directed, lifelong learning capabilities. The studies presented in *Chapters 6, 7 and 8* of this thesis recruited participants from an interprofessional health science unit. Through adopting this recruitment context, SDLR data of students across seven disciplines was efficiently obtained. For physiotherapy and occupational therapy disciplines, the study series made important contributions to the limited evidence base on student SDLR. For podiatry, sports and exercise science, health promotion, health services management, and therapeutic recreation, the study series was able to investigate SDLR and present findings for the first time. In *Chapter 7*, the context of an interprofessional unit also enabled meaningful comparisons of academic performance across disciplines given that students had engaged in the same teaching

and learning activities. Future studies might, therefore, consider using interprofessional units as a context to investigate SDLR, and thereby efficiently contribute to the evidence base across multiple disciplines.

9.4.2 Sample size of cross-sectional studies

This PhD study series presented two cross-sectional studies (*Chapters 6 and 7*), each which had large sample sizes of $n = 407$. These were among the largest studies of SDLR in health disciplines other than medicine or nursing which typically have large enrolments. The sample size in these two studies enabled the researchers to conduct regression analyses to explain the variance in student SDLR, and predict academic performance. This was the first time that regression analysis had been conducted for these purposes in cohorts of students from allied health programs. The studies also had better gender balance (females 56.5%; males 44.5%) than most other comparative studies. This allowed for a more meaningful interpretation of gender differences in student SDLR and academic performance.

9.4.3 First investigation of personality as a potential determinant of SDLR

Student SDLR has been of interest to educators and researchers in the health disciplines for approximately three decades, as identified in *Chapter 4*. Studies have investigated a range of demographic, educational, academic, program and professional factors for potential association with SDLR. Surprisingly, personality factors have not been investigated for potential association with SDLR. This PhD study series was the first to investigate the relationship between SDLR and personality factors in the health disciplines. This was important, given the proposition by Lounsbury, Levy, Park, Gibson, and Smith (2009) that self-directed learning may be a personality trait. Through investigation of personality factors in studies presented in *Chapters 6, 7 and 8*, the PhD study series was able to determine that (i) SDLR was not a trait, (ii) SDLR was influenced by personality factors; and (iii) there was a negative correlation between changes in SDLR and several 'Big Five' personality factors. Together, these findings were suggestive that

programs may be able to influence student SDLR through curricular approaches, however, personality factors are likely to be a mediating factor.

9.4.4 Two studies published in peer-reviewed journals

The PhD study series included two papers (*Chapters 4 and 6*) which have already been accepted and published in the peer-reviewed journals, *Nurse Education Today* (2016 Impact Factor: 2.533) and *BMC Medical Education* (2016 Impact Factor: 1.572) respectively. Feedback from two experts in the field was received for each manuscript. This feedback enabled the authors to revise the work prior to publication. The peer-review process contributed to the strength of the two papers; (i) confirming that the subject matter was of importance for the discipline, (ii) ensuring that methods and interpretations of results were accurate, (iii) minimizing the influence of personal biases, and (iv) cultivating high standards in the quality of the manuscripts (Kelly, Sadeghieh, & Adeli, 2014).

9.4.5 Development of the study series

A series of five studies was presented in this thesis (*Chapters 4 – 9*). Each subsequent chapter was able to draw from and build on the findings of previous chapters. The scoping review (*Chapter 4*) identified SDLR instruments used with students in health disciplines which informed the development of the systematic review protocol manuscript (*Chapter 5*). *Chapter 4* also identified several factors which had received the most attention in the literature, and which had also indicated the most promising relationship with SDLR. These findings informed the inclusion of factors in the cross-sectional investigation of SDLR in first year students (*Chapter 6*). *Chapter 6* investigated personality factors for association with SDLR for the first time, and identified three ‘Big Five’ personality factors (‘conscientiousness’, ‘agreeableness’ and ‘intellect/imagination’) were predictive of SDLR. *Chapters 7 and 8* then went on to further investigate the influence of personality on academic performance, and changes in SDLR over time respectively. Collectively, these studies were able to provide an indication of the

relationship of SDLR and personality, and importantly, that SDLR was not a stable trait, but rather influenced by a range of factors.

9.5 Study limitations

Limitations of individual studies have also been discussed in respective chapters. There are, however, several other limitations of the collective PhD study series.

9.5.1 Baseline data

An investigation of the influence of SDLR, demographic, academic and personality factors on academic performance was presented in *Chapter 7*. One of the significant findings of the study was that discipline was associated with academic performance, and was also significant in a predictive model accounting for 25% of the variance in academic performance. It was discussed in *Chapter 7* that discipline may be a proxy for ‘on entry’ academic ability, given that the disciplines which had higher SDLR had higher threshold ATAR (Australian Tertiary Admission Rank) scores for school-leaver entry in to the programs. Collection of student ATAR scores would have enabled investigation of this relationship, however, the researchers did not have access to this data. Given that (i) discipline was associated with academic performance, (ii) post-hoc analyses revealed significant differences between several disciplines, and (iii) discipline was significant in the regression analysis; it is important that future research include baseline academic performance measures to identify whether discipline is acting as a proxy for academic ability, or another factor not yet identified.

9.5.2 Follow-up rate

Chapter 8 presented the manuscript for a longitudinal cohort study investigating changes in student SDLR between first year, first semester and third year, second semester. From an entering cohort of 584 students ($n = 407$ completing the first-year survey), only 91 students completed both surveys; a follow up rate of 22.4%. Given the low retention of participants in

the study, the study is at risk of selection bias such that the sample may not be representative of the student cohort. Voluntary participation in the follow up survey is likely to be a critical factor in the loss to follow-up. As the follow up study was conducted in the final four weeks of the semester, a peak student assessment period, many students may have prioritized coursework over voluntary participation in a study. Also, given that the follow-up survey was administered in the final semester for health science and sports and exercise science students, motivation to complete the survey may have been low. This may explain the particularly low follow up rate of 4% in the sports and exercise science program. As discussed in *Chapter 8*, a cross-sectional design was first used to investigate student SDLR in in first year, first semester, however in 2012, there was the opportunity to re-administer the SDLRS with the same cohort and, thereby, collect longitudinal data. It is apparent that re-conceptualising and changing the research design did influence participant retention in the follow up study. The results, however, still make an important contribution to what is known about changes in student SDLR over time, particularly given that it is the second largest longitudinal study involving students in allied health programs, and the first to identify a correlation between SDLR change and both GPA and personality factors. Further investigation of changes in student SDLR over time should adopt a longitudinal design from inception, with identified strategies to support participant retention.

9.6 Implications of the study series

The findings from this PhD study series have implications for educational programs, research and policy.

9.6.1 Implications for educational programs

Through investigating the SDLR of students in pre-certification health professional programs, the current study series has a number of key implications for stakeholders in the education and education program process; in particular, faculty and program administrators of health professional programs. An overall decline in students SDLR over time was observed in students across seven disciplines. This finding was congruent with several other findings (Kell,

2006; Premkumar et al., 2013, 2014). While the current study series did not investigate the influence of different teaching and learning approaches, it did indicate that traditional approaches (e.g. didactic teaching) are unlikely to positively influence student SDLR over time. In the existing literature, there is indication that teaching and learning approaches which necessitate or anticipate higher degrees of self-directed learning may have a positive influence on student SDLR (Duman & Sen, 2012; Kocaman, Dicle, & Ugur, 2009; Malta, Dimeo, & Carey, 2010; Tsou et al., 2009). It, therefore, cannot be assumed that SDLR will increase over the duration of programs, simply due to exposure to the curriculum, or student maturation. While further research is needed, these findings suggest that health professional programs may need to adopt a targeted approach to developing students' SDLR over the duration of the program.

The PhD study series also identified that that personality factors and academic capacity (indicated by GPA) are associated with these changes. Given that this was the first study to investigate the association between personality and changes in SDLR over time, further research is warranted. That said, personality and academic performance indicators may be useful for programs in identifying students who might require additional support to develop self-directed, lifelong learning attitudes and abilities.

The findings from the study in *Chapter 6* present particular implications for health professional preparation programs. It was found that program, previous education level and three personality factors ('intellect/imagination', 'agreeableness', and 'conscientiousness') accounted for 52.9% of the variance. Academic programs, may therefore, need to provide additional support to school-leavers (compared with those who have commenced or completed a higher education degree), and those students with lower scores on the three personality factors in developing self-directed, lifelong learning abilities. Additionally, as discussed in *Chapter 6*, program may also be a proxy for academic ability given that students in programs which required higher ATAR entry scores had higher SDLR. While this requires further investigation, there may be implications for

programs, particularly those with lower ATAR entry scores, as to the level of support students need to develop self-directed, lifelong learning attitudes and abilities.

The PhD study series also investigated the utility of SDLR in predicting academic performance. It was found that, while SDLR was associated with academic performance, it was not a significant predictor in the regression model. This finding indicates that the practical benefit of SDLR is more likely related to professional practice competencies, rather than academic performance. This informs educators about the utility of SDLR in the curriculum.

9.6.2 Implications for research

9.6.2.1 Implementation of the systematic review protocol

The PhD study series presented a manuscript for a systematic review protocol to investigate the psychometric properties of instruments measuring SDLR (*Chapter 5*). In following the best practice PRIMSA-P guidelines (Moher et al., 2015), a systematic review protocol was first developed and then the systematic review was registered in the prospective database, PROSPERO. The next phase of the systematic review process is implementation of the protocol. The findings from this systematic review will, for the first time, provide an analysis of the psychometric properties of SDLR instruments used with students in the health disciplines. Once the review has been completed, a manuscript presenting the findings will be developed shortly thereafter. It is intended that the manuscript will be submitted to the journal, *Medical Teacher*, for peer-review. The findings of this systematic review will assist researchers and educators to select robust measures appropriate for use with students in health professional programs.

9.6.2.2 Investigation of factors influencing student SDLR

Chapters 4 and *6* add to the evidence base relating to factors which have an association with SDLR. Several factors were found to have a significant relationship with SDLR: age, gender, year level, previous higher education experience, discipline, personality. The latter three factors

were significant in a regression analysis explaining SDLR variance. From a variables point of view, these findings highlight the need for age, gender, previous higher education experience and discipline to be routinely included as potential factors in future investigation of student SDLR. This PhD study series also presented the first study of personality factors as potential determinants of SDLR. Given that personality factors were significant in the regression analysis explaining variance in student SDLR (*Chapter 6*), and had a moderate negative correlation with the change in SDLRS score (*Chapter 8*), personality factors should also be included in future studies.

Arising from the PhD study series, it is apparent that particular attention is warranted to further explore the ‘age - year level – previous higher education experience’ interaction. The scoping review (*Chapter 4*) identified that each of these factors demonstrated nascent evidence of association with SDLR. It was discussed that these factors each have the passing of time and the accumulation of life experience in common, and may be proxy measures for constructs such as individual cognitive or social development, or individual occupational socialization. Further investigation is, therefore, recommended to clarify influential factors. It was also found in

Chapter 6 that both age and previous higher education experience were associated with SDLR, however, only previous higher education experience was significant in the regression analysis. It was recommended that further research is required to determine whether it is the development of generic skills or attitudes in higher education, or the exposure to particular teaching and learning approaches which is most influential.

Chapter 4 identified that six instruments had been used in the literature to measure students’ SDLR. The most common instruments used were the SDLRS (Guglielmino, 1978) and the SDLRSNE (Fisher et al., 2001). While there have been psychometric studies of individual instruments (Cheng, Lee-Hsieh, Turton, & Lin, 2014; Crook, 1985; Fisher et al., 2001; Fisher & King, 2010; Hendry & Ginns, 2009; Hoban et al., 2005; McBride, 1987; Nadi & Sadjadian, 2011;

Williams & Brown, 2013), to date, no study has examined and compared the psychometric properties of the range of instruments used to measure SDLR of students in pre-certification health professional programs to assist researchers to make informed decisions about instrument use. The systematic review, as outlined in *Chapter 5*, will address this gap in the literature.

The current study series was one of few studies (Alotaibi, 2016; Linares, 1999; Malta et al., 2010) which investigated SDLR across multiple programs, and to date, the only known study which has investigated the SDLR of students in interprofessional cohorts. Given increasing institutional and industry drivers for interprofessional education, studies in interprofessional contexts can provide an efficient approach to gathering data across several disciplines, and allow for meaningful comparisons between disciplines. Additionally, pre-certification programs in the allied health disciplines typically have a much smaller enrolment than medicine and nursing. As discussed in *Chapter 7*, future research in the allied health disciplines also might consider aggregating data to assist with illuminating significant relationships between SDLR and factors of interest which may be otherwise difficult to identify in small samples.

While beyond the scope of this PhD study series, there is a need to investigate the how the development of student SDLR in pre-certification programs influences engagement in self-directed, lifelong learning in clinical practice. It is assumed that these attitudes and skills for self-directed learning translate to health professional competence in independently maintaining practice currency. Empirical evidence is required, however, to determine whether SDLR influences the quality and quantity of self-identified, self-initiated continuing professional development undertaken by health professionals in practice.

9.6.2.3 Investigation of changes in student SDLR over time

The findings from this PhD study series suggest that students' SDLR does not increase over time through traditional teaching and learning approaches, or student maturation. Evidence in the existing literature suggests that a targeted approach can positively influence SDLR over time

(Cheng, Liou, et al., 2014; Malta et al., 2010; Rezaee & Mosalanejad, 2015; Şenyuva & Kaya, 2015; Tsou et al., 2009), however few studies exist comparing the influence of differing educational approaches. There is, therefore, a need to add to the existing evidence confirming that SDLR can be taught, and identify the educational approaches which are most effective in increasing students' SDLR over the duration of their program. As indicated in *Chapters 4* and *6*, inclusion of factors considered to be stable over time (e.g. learning styles and personality traits) in future studies will be important in adding to the discussion about whether SDLR can be taught. Future research might then consider comparing the effect of different educational approaches (e.g. problem-based learning, flipped classrooms, and traditional teaching and learning) through experimental studies and systematic review.

9.6.2.4 Investigation of the academic performance

Chapter 7 found significant relationships between students' academic performance and each of SDLR, personality factors, gender and discipline. Gender and discipline were also significant in a regression analysis predicting academic performance in a first year, first semester interprofessional health sciences unit. It was recommended that future studies should routinely include gender and discipline when investigating student academic performance. As few studies in the health disciplines have investigated the influence of personality factors on academic performance, personality should also be included as a factor of interest in future studies.

Chapter 7 also identified disciplinary differences in students' academic performance; highest in physiotherapy and occupational therapy, followed by podiatry, sports and exercise sciences, and health sciences programs. As academic performance between disciplines was congruent with the order of threshold ATAR scores required for program entry, it was suggested that discipline was inadvertently acting as a proxy for 'on entry' academic ability. Future research investigating disciplinary differences in academic performance, particularly in a first-year unit, should include baseline academic performance measures, such as standardised school-leavers' academic entry scores to determine whether it is discipline or academic ability on entry that is the potent factor.

9.6.2.5 Investigation of SDLR in professional practice

The current PhD study series investigated the SDLR of students in health professional programs. While investigation of the SDLR of qualified health professionals was out of scope of the current research project, further research is needed to explore (a) whether there are changes in SDLR as students transition into professional practice, and (b) how SDLR influences self-directed, lifelong learning of health professionals in maintaining knowledge and skill currency.

9.6.3 Implications for policy

As discussed in *Chapter 1*, self-directed, lifelong learning is widely understood to be important in the maintenance of knowledge and skill currency to ensure that health professionals use the most advanced evidence and approaches available the provision of high quality health care. Health professions have, therefore, commonly included accreditation standards which require pre-certification programs to ‘teach’, ‘develop’ or ‘build’ students’ attitudes and abilities for self-directed, lifelong learning. The assumption reflected in these accreditation standards is that self-directed, lifelong learning attitudes and abilities are amenable to instruction or influence by programs.

Institutions have also had a keen interest in developing students’ self-directed, lifelong learning attitudes and abilities, as reflected in the graduate attributes statements of many universities. Universities aim to develop these graduate attributes in all students across the institutions, not just those in health professional programs, particularly as preparation of students for lifelong learning is mandated through the Australian Qualifications Framework (Australian Qualifications Framework Council, 2013). Again, the assumption that self-directed, lifelong learning attitudes and abilities can be developed over time.

This PhD study series has findings informing both professional accreditation standards, and institutional efforts to actualize graduate attribute statements. Firstly, that student SDLR can change over time, however, despite institutional graduate attributes statements promoting self-

directed, lifelong learning, SDLR appears to decrease when traditional teaching and learning approaches are used. The literature suggests that targeted educational approaches are required, however this does require further investigation. If this is the case, however, program accreditation standards may need to give programs more guidance on the types of instruction which lead to increased self-directed, lifelong learning attitudes and abilities. Similarly, universities will need to adopt evidence-based institutional efforts to develop these graduate attributes during students' enrolment in their program.

9.7 Conclusion

This PhD study series has explored the SDLR of students in pre-certification health professional programs. Several factors were identified to be associated with student SDLR; in particular personality factors, previous education and academic program which accounted for over half of the variance in student SDLR. The study series also identified an overall decline in student SDLR over time, and explored the utility of SDLR in predicting student academic performance. The findings from this study series will inform health professional programs as they in their curricular efforts to develop students' self-directed, lifelong learning attitudes and abilities. This PhD study series has made an original contribution to the health professional education evidence-base. Firstly, it presented SDLR data for seven disciplines; four of which, for the first time. It was also the first study in the health disciplines to conduct a regression analyses explaining variance in student SDLR. Additionally, the study investigated the relationship between personality factors and SDLR, which has never previously been done before. It also investigated personality factors for association with academic performance, which was the first time for several disciplines. Importantly, this PhD study series has shown that SDLR is not a trait – it changes over time; and that it can be influenced by a range of factors. In better understanding student SDLR, pre-certification health professional programs can better prepare students for the professional responsibility of being self-directed, lifelong learners in professional practice.

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Appendices

Appendix A Study recruitment email

Dear Student,

Would you like to participate in a study on student learning styles?

I am conducting a research project entitled “Non-traditional students in health professional preparation programs: Male, mature and culturally diverse”.* This project forms part of a Masters/PhD program in which I am supervised by Prof. Anne Cusick from School of Health Sciences at University of Wollongong. The study is open to **all** students in year 3 of a health science course at UWS.

What is the purpose of the study?

The study aims to develop an understanding of different learning styles of students enrolled in health science course at UWS and determine the effect of the university experience over time, particularly in certain student groups.

What does it involve?

Participation is voluntary and will involve the completion of 2 surveys online. Altogether this will take approximately 20 minutes. Questions in the survey will relate to your approaches to studying and learning.

The surveys will be open until 30th November 2012.

Paper copies of the surveys will be available if you would prefer to complete a paper copy rather than an online survey. You are free to withdraw your participation at any point in the study.

The results from these surveys will be matched to a set of surveys you completed in 400871 – Professional Health Competencies in 2010. Your results will also be matched to some data from your enrolment record and academic record. The reason we want to do this, is to see if there have been any changes to your learning style over the past 3 years, whether this has an impact on your academic success and whether there are any trends in different student groups.

How will my confidentiality be protected?

The matching of your information will be done by a research assistant who is not associated with UWS. The research assistant will only give the data to the researchers after all student numbers are removed. This will mean that we will not be able to identify you in the data. Further information can be found in the participation information sheet attached to this email.

How can it benefit me?

All participants will do into a draw with a chance to win 1 of 5 x JB HiFi or Coles gift cards worth \$100 each. There are five gift cards to be won and winners will be selected at random by a research assistant who has no affiliation with UWS. You may also choose to receive the results of your surveys which you may find useful in understanding your own learning style.

* Refer to Chapter 3 (3.7.1) for details of title change.

Your decision to participate, not participate or withdraw your participation in no way affects your grade in any unit, your relationship to the teaching staff at UWS, their colleagues or the governing institution.

How do I participate?

If you would like to participate in this study, then please read the participant information sheet attached to this email. Once you have read the participant information sheet, then you can either complete the surveys online at: <http://www.surveymonkey.com/s/learningprofile> or alternatively you can collect a hardcopy of the surveys from Craig Slater.

Please email or call me (details provided below) if you would like to discuss this study with me further.

Kind regards

Craig Slater
HDR Student
University of Wollongong
ces985@uowmail.edu.au
(02) 4620 3655

Appendix B Participant information sheet



University of Wollongong



PARTICIPANT INFORMATION SHEET (SURVEYS)

Project Title: Non-traditional students in health professional preparation programs: Male, mature & culturally diverse*

Chief Investigator: Mr. Craig Slater
HDR Student
School of Health Sciences
University of Wollongong
ces985@uowmail.edu.au
Ph: 4620 3655

Associate Lecturer
School of Science & Health
University of Western Sydney

Craig Slater is an associate lecturer at University of Western Sydney. He is also a HDR student at University of Wollongong, and is being supervised by Prof. Anne Cusick.

Chief Investigator: Prof. Anne Cusick
School of Health Sciences
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Background:
Students have various strategies and approaches to learning. These approaches to learning may have an effect on academic performance in undergraduate education. Over time, these approaches may change, and changes may be similar or different for various groups of students.

Aims:
This study aims to develop an understanding of the learning styles of students in health professional preparation programs at UWS. It seeks to determine the effect of the university experience on learning styles over time and identify the impact of learning styles on academic performance among various groups of students.

Study benefits:
This study will help the School of Science and Health at UWS understand the learning styles of students in health professional preparation programs, and will be useful in further developing teaching and learning approaches used in units and across programs. You may choose to receive the results of your surveys which you may find useful in understanding your own learning style.

Students who participate in the study will be eligible to win one of five JB HiFi or Coles Group & Myer gift cards. Student numbers of participants will be drawn at random by a research assistant who will have no affiliation with UWS. There are only five gift cards to be won. Winners may choose which gift card they would like. Winners will be notified by an email from the research assistant one month after the surveys close.

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CRICOS Provider No: 00102E

* Refer to Chapter 3 (3.7.1) for details of title change.

Overview of the study:

If you choose to participate in the study, you will complete two surveys during Spring session in 2012. Altogether, the surveys should take approximately 20 minutes to complete. The surveys will be available online at www.surveymonkey.com/s/learningprofile or you may choose to complete a paper copy of the surveys which you can obtain from Craig Slater (ces985@uowmail.edu.au). The surveys have all been used before with university students in Australia and overseas. Questions are asked about your approaches and attitudes to your studies.

Confidentiality:

One of the questions in the surveys asks you to provide your student number. This will be used to link your data to results of a survey you completed in 400871 - Professional Health Competencies in 2010. These results will then be linked with data from your academic record and some enrolment data. When this is done, your student number will be deleted. The matching of data will be done by a research assistant who is not affiliated with UWS. The research assistant will delete your student number before the researchers have access to the data. At *no time* will the researchers ever see your student number linked to your data. Therefore, the researchers will not be able to identify individual students, and all students will be de-identified in the dissemination of results and in any archived data. The reason we want to do this is to see if there have been any changes to your learning style over the past 3 years, whether this has any impact on your academic success, and whether there are trends in different student groups. The academic registrar at UWS has granted approval to access participants' student records.

Participation in the study:

Participation in this study is voluntary. If you do choose to participate in the study, you may withdraw at any time without giving reason and without consequences. Your participation, non-participation or withdrawn participation will not affect your grade in any unit, your relationship to the teaching staff at UWS/UoW, their colleagues or the governing institution. You consent to participating in the study and the use of your information as listed in this participation sheet is implied by you completing the surveys. If you have any questions about the study and would like to discuss the study further, please feel free to contact Craig Slater by telephone or email.

Risks involved in the study:

There are no known risks involved in completing the online surveys, and all your information will be kept confidential.

Use of the results:

The results of this study will contribute to a research dissertation. De-identified results from this study will be published in peer-reviewed journals and results presented at relevant conferences.

Ethics Approval:

This study has been approved by the University of Western Sydney Human Research Ethics Committee (Approval number: H9857), and the Joint University of Wollongong & Illawarra Shoalhaven Local Health District Social Science Human Research Ethics Committee (Approval number: HE12/226).

Complaints:

If you wish to make a complaint about the conduct of this research please contact the Joint University of Wollongong & Illawarra Shoalhaven Local Health District Social Science Human Research Ethics Committee (Tel: 02 4221 4457) or University of Western Sydney Human Research Ethics Committee (Tel: 02 4736 0833 / Email: humanethics@uws.edu.au). All issues will be treated in confidence and you will be informed of the outcome of the investigation.

If you agree to participate in this study, please use the following link to go directly to the online survey (www.surveymonkey.com/s/learningprofile) or contact Craig Slater (ces985@uowmail.edu.au) to obtain a paper copy of the survey.

Kind Regards

Craig Slater & Prof. Anne Cusick

Page 2 of 2

Appendix C Survey entry page (Year 1)

1. About You

Survey results are completely confidential. No tutor or lecturer will see identifiable individual results. Your student ID number will be permanently removed as follows...

A project assistant who does not teach will:

1. Analyse your survey with descriptive statistics
2. Mark your survey as 'received' on the modules sheet
3. Send your confidential score result if you requested it
4. Delete your student ID number so no link can be made between your identity and the scores that are kept
5. Check all results are de-identified and anonymous
6. Prepare the anonymous group summary
7. Send you the group summary in Week 17 so you can compare yourself

1. DO YOU WANT TO RECEIVE YOUR ANALYSED SURVEY SCORE?

These will be sent to your UWS email address by the project assistant, then your ID number will be permanently deleted from the survey record.

☐ YES

☐ NO

*2. What is your student ID number?

3. What is your gender?

☐ Male

☐ Female

4. How old are you?

☐ Less than 18 years

☐ 18-21 years

☐ 22-25 years

☐ 26-35 years

☐ 36 years or more

5. Are you enrolled in a degree that you want to finish?

☐ Yes

☐ No

☐ Not sure

☐ Don't care

*6. Use of your responses

	NO	YES
Can we add your de-identified/ anonymous results to other surveys to make a group summary?	<input type="radio"/>	<input type="radio"/>
Can we use your de-identified/ anonymous results in teaching other health science students?	<input type="radio"/>	<input type="radio"/>
Can we use your de-identified/ anonymous results in any future research about health science students?	<input type="radio"/>	<input type="radio"/>

Appendix D Survey entry page (Year 3)

STUDENT LEARNING PROFILE SURVEY

Thank you for participating in this student learning profile survey.

Participants of this survey will be eligible to go into a draw to win 1 of 5 JB HiFi or Coles Supermarket gift cards valued at \$100. To go into the draw, you need to correctly enter your student ID number below, and complete all items of the survey. A research assistant will notify the winners through their UWS student email account.

In this survey there are 2 questionnaires.

- Learning Preference Assessment (Guglielmino, 1977)
- Approaches & Study Skills Inventory for Students (Tait & Entwistle, 1996)[#]

It is anticipated that the full survey will take approximately 15 minutes to complete.

Your responses to this survey will be treated confidentially.
 Your responses will be matched with existing data and then permanently de-identified by a research assistant independent of UWS.
 At no time will the researchers, or any of the staff at UWS, see your student number linked to your responses.

What is your student ID number?

What course are you currently enrolled in?

- ☐ Health Sciences (Therapeutic Recreation / Health Promotion / Health Services Mgt)
- ☐ Occupational Therapy
- ☐ Physiotherapy
- ☐ Podiatry
- ☐ Sport & Exercise Sciences
- ☐ Traditional Chinese Medicine
- ☐ Other

[#] This data was not used in the PhD study series

Appendix E ‘400871 - Professional Health Competencies’ unit description, delivery and assessment

Unit description

This unit introduces skills for studying and working in health science. Students will gain an understanding of the interdisciplinary and multi-disciplinary nature of health science practice in the 21st century, and how this interacts with the specialty health professions, client and community expectations of health care and employment opportunities in health science. Students will learn foundation competencies that will underpin their academic development and their safe, responsible and ethical practice in health science service environments.

Excerpt from:

2010 Undergraduate Handbook

University of Western Sydney, College of Health and Science

Available at: <http://handbook.westernsydney.edu.au/hbook/download.aspx>

Mode of delivery

Students participated in 1 x 1-hour lecture and 1 x 1-hour tutorial each week over a 14-week semester.

Assessment tasks

Students had to attempt all assessment items and achieve a total mark of 50% or above to pass the unit.

Assessment Item	Weighting
<ul style="list-style-type: none"> Online competency quizzes x 4 <ul style="list-style-type: none"> i. Successful Searching Quiz ii. UWS OH&S Quiz iii. Infection Control Quiz iv. Child Protection Quiz 	Satisfactory / Unsatisfactory
<ul style="list-style-type: none"> Annotated Bibliography (1000 words) 	30%
<ul style="list-style-type: none"> Case study assignment (1500 words) 	40%
<ul style="list-style-type: none"> Online unit reviews x 2 	20%
<ul style="list-style-type: none"> Tutorial participation 	10%

Appendix F Common units in programs

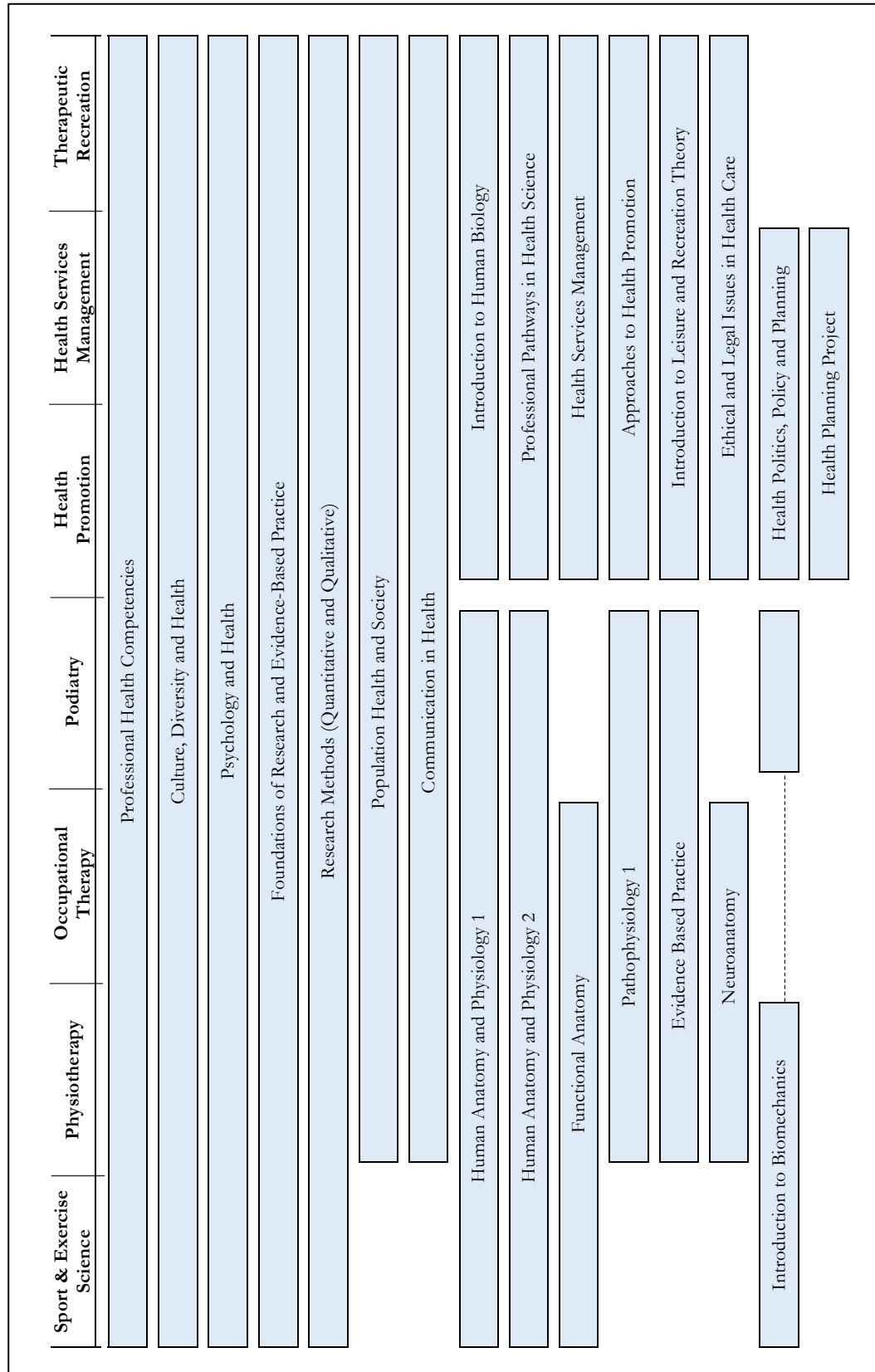


Figure 11.1 Common units mapped across programs included in the PhD study series.

Appendix G Program specific units in programs

<p>Health Promotion (3 year program)</p> <ul style="list-style-type: none"> • Injury Prevention • Public Health • Health Promotion Practice 1 • Health Promotion Practice 2 • Professional Transition Project • 4x electives 	<p>Health Services Management (3 year program)</p> <ul style="list-style-type: none"> • Health Services Management Practice • Health Services Financial Management • Health Services Workforce Management • Professional Transition Project • 5 x electives
<p>Sport and Exercise Science (3 year program)</p> <ul style="list-style-type: none"> • Fundamentals of Exercise Science • Exercise Bioenergetics • Sport and Exercise Psychology • Sport and Exercise Physiology • Exercise in Musculoskeletal Rehabilitation • Applied Biomechanics of Sport and Exercise • Exercise Nutrition, Body Composition and Weight Control • Professional Development and Work Experience • Work Experience in Sport and Exercise Science 	<p>Therapeutic Recreation (3 year program)</p> <ul style="list-style-type: none"> • Professional Practice in Aged Care and Disability • Workplace Learning 1 (Therapeutic Recreation) • Leisure Education Programming and Mental Health • Workplace Learning 2 (Community Placement) • Professional Transition Project • Therapeutic Recreation Professional Project • 5 x electives
<p>Occupational Therapy (4 year program)</p> <p><i>Completion by the end of Year 3:</i></p> <ul style="list-style-type: none"> • Introduction to Occupational Therapy • Occupational Therapy Practice 1 • People, Environment and Occupations • Occupational Therapy Practice 2 • Occupation and Neurology • Occupation and Mental Health • Occupational Therapy Process • Occupational Therapy Practice 3 • Occupational Therapy Theory and Practice • Child and Adolescent Occupations • Occupation and the Environment • Occupation and Ageing <p><i>Completion in Year 4:</i></p> <ul style="list-style-type: none"> • Occupational Therapy Project • Occupational Justice • Ergonomics and Work Occupations • Occupational Therapy Specialties • Professional Reasoning • Occupational Therapy Practice 4 • Occupational Therapy Practice 4 Workshop 	<p>Physiotherapy (4 year program)</p> <p><i>Completion by the end of Year 3:</i></p> <ul style="list-style-type: none"> • Introduction to Physiotherapy Practice • Core Competencies in Physiotherapy Practice • Clinical Pharmacology • Cardiorespiratory Physiotherapy • Neurological Physiotherapy • Orthopaedic Physiotherapy • Clinical Education A (Acute Care) • Exercise Rehabilitation • Neurological Rehabilitation • Musculoskeletal Physiotherapy <p><i>Completion in Year 4:</i></p> <ul style="list-style-type: none"> • Paediatric Physiotherapy • Physiotherapy for Chronic Illness and Disease • Complex Cases and Professional Issues • Integrating Research into Physiotherapy Practice • Clinical Education B (Rehabilitation) • Clinical Education C (Ambulatory Care) • Clinical Education D (Paediatrics) • Clinical Education E (Advanced Care)
<p>Occupational Therapy (4 year program)</p> <p><i>Completion by the end of Year 3:</i></p> <ul style="list-style-type: none"> • Introduction to Occupational Therapy • Occupational Therapy Practice 1 • People, Environment and Occupations • Occupational Therapy Practice 2 • Occupation and Neurology • Occupation and Mental Health • Occupational Therapy Process • Occupational Therapy Practice 3 • Occupational Therapy Theory and Practice • Child and Adolescent Occupations • Occupation and the Environment • Occupation and Ageing <p><i>Completion in Year 4:</i></p> <ul style="list-style-type: none"> • Occupational Therapy Project • Occupational Justice • Ergonomics and Work Occupations • Occupational Therapy Specialties • Professional Reasoning • Occupational Therapy Practice 4 • Occupational Therapy Practice 4 Workshop 	<p>Podiatry (4 year program)</p> <p><i>Completion by the end of Year 3:</i></p> <ul style="list-style-type: none"> • Introduction to Podiatry • The Appendicular Skeleton • Pharmacology • Podiatry Pre-Clinical • Approaches to Health Promotion • Podiatric Techniques 1A • Podiatric Techniques 1B • Podiatric Practice 1 • Podiatric Techniques 2A • Podiatric Techniques 2B • Podiatric Practice 2 • 1 x elective <p><i>Completion in Year 4:</i></p> <ul style="list-style-type: none"> • Podiatric Techniques 3A • Podiatric Techniques 3B • Podiatric Techniques 3C • Podiatric Practice 3 • Podiatric Professional Practice Studies • Podiatric Clinical Block • Podiatric Practice 4

Figure 11.2 Program specific units in programs included in the PhD study series.

Appendix H Self-Directed Learning Readiness Scale (Guglielmino, 1978)

The SDLRS is copyrighted and may not be used without permission or purchase. The SDLRS was purchased from Guglielmino & Associates LLC for the purposes of this PhD study series.

Further details about purchase and use of the instrument can be found on the SDLRS website

<http://www.lpasdlrs.com/>.

Appendix I 'Big Five' Personality Trait Inventory (IPIP) (Goldberg, 1992)

The IPIP website (<http://ipip.ori.org/>) reads:

The items and scales (of the IPIP) are in the public domain, which means that one can copy, edit, translate, or use them for any purpose without asking permission and without paying a fee.

The survey administered to students did not include indication of whether items were + or – keyed, nor did it include the scoring instructions. These details are provided to give the reader an understanding of how the instrument is used. Further details can be found on the IPIP website (<http://ipip.ori.org/newBigFive5broadKey.htm>)

+ / - keyed	Item	Responses				
		Disagree	Slightly disagree	Neutral	Slightly agree	Agree
Extraversion						
+	I am the life of the party.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I feel comfortable around people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I start conversations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I talk to a lot of different people at parties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I don't mind being the centre of attention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-	I don't talk a lot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I keep in the background.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have little to say.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I don't like to draw attention to myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am quiet around strangers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agreeableness						
+	I am interested in people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I sympathize with others' feelings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have a soft heart.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I take time out for others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I feel others' emotions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I make people feel at ease.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-	I am not really interested in others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I insult people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am not interested in other people's problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I feel little concern for others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

+ / - keyed	Item	Responses				
		Disagree	Slightly disagree	Neutral	Slightly agree	Agree
Conscientiousness						
+	I am always prepared.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I pay attention to details.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I get chores done right away.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I like order.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I follow a schedule.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am exacting in my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-	I leave my belongings around.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I make a mess of things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I often forget to put things back in their proper place.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I shirk my duties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emotional Stability						
+	I am relaxed most of the time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I seldom feel blue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-	I get stressed out easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I worry about things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am easily disturbed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I get upset easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I change my mood a lot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have frequent mood swings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I get irritated easily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I often feel blue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intellect / Imagination						
+	I have a rich vocabulary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have a vivid imagination.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I have excellent ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am quick to understand things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I use difficult words.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I spend time reflecting on things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am full of ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-	I have difficulty understanding abstract ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I am not interested in abstract ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	I do not have a good imagination.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Scoring instructions	
For + keyed items	Agree = 5 Slightly agree = 4 Neutral = 3 Slightly disagree = 2 Disagree = 1
For – keyed items	Agree = 1 Slightly agree = 2 Neutral = 3 Slightly disagree = 4 Disagree = 5

Appendix J University of Wollongong/ISLHD HREC conditional approval



CONDITIONAL APPROVAL
In reply please quote: HE12/226

23 August 2012

Mr Craig Slater
University of Western Sydney
School of Science & Health
Campbelltown Campus - Building 24
Locked Bag 1797
PENRITH NSW 2751

Dear Mr Slater

I am pleased to advise that the Human Research Ethics application referred to below has been **approved subject to the process outlined in Question 9 being completed involving approval from the University of Western Sydney.**

Ethics Number: HE12/226

Project Title: Non-traditional students in health professional preparation programs: Male, mature and culturally diverse*

Researchers: Mr Craig Slater, Professor Anne Cusick

Reviewed Date: 23 August 2012

Approval Date: 23 August 2012

Expiry Date: 22 August 2013

The University of Wollongong/ISLHD Social Sciences HREC is constituted and functions in accordance with the NHMRC *National Statement on Ethical Conduct in Human Research*. The HREC has reviewed the research proposal for compliance with the *National Statement* and approval of this project is conditional upon your continuing compliance with this document.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at <http://www.uow.edu.au/research/rso/ethics/UOW009385.html>. This report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone (02) 4221 3386 Facsimile (02) 4221 4338
Email: rso-ethics@uow.edu.au Web: www.uow.edu.au

* Refer to Chapter 3 (3.7.1) for details of title change.

As evidence of continuing compliance, the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

Please note that approvals are granted for a 12 month period. Further extension will be considered on receipt of a progress report prior to expiry date.

If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email rso-ethics@uow.edu.au.

Yours sincerely

A/Professor Garry Hoban
**Chair, Social Sciences
Human Research Ethics Committee**

Appendix K Western Sydney University HREC ethics approval

UWS HUMAN RESEARCH ETHICS COMMITTEE

6 September 2012

Professor Anne Cusick,
School of Science and Health

Dear Anne,

I wish to formally advise you that the Human Research Ethics Committee has approved your research proposal **H9857** *“Non-traditional students in health professional preparation programs: Male, mature and culturally diverse”*^{*k}, until 22 August 2013 with the provision of a progress report annually and a final report on completion.

Please quote the project number and title as indicated above on all correspondence related to this project.

This protocol covers the following researchers:
Anne Cusick, Craig Slater.

Yours sincerely

Dr Anne Abraham
Chair, UWS Human Research Ethics Committee

a.cusick@uws.edu.au
c.slater@uws.edu.au

* Refer to Chapter 3 (3.7.1) for details of title change.

Appendix L University of Wollongong/ISLHD HREC ethics approval



DOCUMENT NOTED
In reply please quote: HE12/226

27 September 2012

Mr Craig Slater
University of Western Sydney
School of Science & Health
Campbelltown Campus - Building 24
Locked Bag 1797
PENRITH NSW 2751

Dear Mr Slater

I am pleased to advise that the information document listed below relating to the following Human Research Ethics application has been noted.

Ethics Number: HE12/226

Project Title: Non-traditional students in health professional preparation programs: Male, mature and culturally diverse*

Document: Receiprocal approval from the University of Western Sydney Human Research Ethics Committee dated 6/9/12

Name of Researchers: Mr Craig Slater, Professor Anne Cusick

Yours sincerely

A/Professor Garry Hoban
Chair, Social Sciences
Human Research Ethics Committee

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone (02) 4221 3386 Facsimile (02) 4221 4338
Email: rso-ethics@uow.edu.au Web: www.uow.edu.au

* Refer to Chapter 3 (3.7.1) for details of title change.

**Appendix M PhD title update: Excerpt from 2016
University of Wollongong/ISLHD HREC
progress report**

- 5. Are any variations to the approved protocol/project proposed? If so, please detail below, noting that they must be approved by the HREC (attach an extra sheet if needed).**

Given that the students interviews did not occur (as explained in the 2013 & 2014 progress reports), the surveys were the principal dataset for the study. In analysing the data, and in light of the developments in self-directed learning readiness, the focus of the study has shifted to self-directed learning readiness of students in health professional preparation programs. The project is now titled: “Self-directed learning readiness of undergraduate students in health professional preparation programs: Informing teaching and learning approaches”. There are no changes to recruitment, data collection or data storage as they have all occurred in line with the approved protocol. The only change is the analysis and writing up of the thesis to focus on self-directed learning readiness of students rather than non-traditional students. The analysis and dissemination of results will occur in line with the approved protocol, such that only grouped data will be presented and no individual participants will be identifiable.

Appendix N PhD title update: Excerpt from 2016 Western Sydney University amendment request form

Section 6: Changes to the design of the project

6.1 Which of the following was selected in 1.5?

- ☐ Change to research design
- ☐ Change to recruitment procedure
- ☒ Administrative / Other

6.2 Provide a detailed description of the change(s)

Change the project title to “Self-directed learning readiness of undergraduate students in health professional preparation programs: Informing teaching and learning approaches”.

There are no changes to recruitment, data collection or data storage as they have all occurred in line with the approved protocol. The only change is the analysis and writing up of the thesis to focus on self-directed learning readiness of students rather than non-traditional students. The analysis and dissemination will occur in line with the approved protocol, such that only grouped data will be presented and no individual participants will be identifiable.

Appendix O PhD title update: 2016 University of Wollongong/ISLHD HREC approval



UNIVERSITY
OF WOLLONGONG
AUSTRALIA

RENEWAL APPROVAL
In reply please quote: HE12/226
Further Enquiries Phone: 4221 3386

19 August 2016

Craig Slater
University of Western Sydney - Campbelltown Campus
School of Science & Health - Building 24
Locked Bag 1797
PENRITH NSW 2751

Dear Mr Slater,

Thank you for submitting the progress report. I am pleased to advise that **renewal** of the following Human Research Ethics application has been **approved**.

Ethics Number: HE12/226
Project Title: Non-traditional students in health professional preparation programs: Male, mature and culturally diverse
Researchers: Mr Craig Slater, Professor Anne Cusick
Renewed From: 23 August 2016
New Expiry Date: 22 August 2017

Please note that approvals are granted for a twelve month period. Further extension will be considered on receipt of a progress report prior to the expiry date.

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at <http://www.uow.edu.au/research/ethics/UOW009385.html>. This report must be completed, signed by the appropriate Head of School and returned to the Research Services Office prior to the expiry date.

If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email rso-ethics@uow.edu.au.

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone (02) 4221 3386
Email: rso-ethics@uow.edu.au Web: www.uow.edu.au

Yours sincerely,

Professor Colin Thomson
Chair, UOW & ISLHD Health and Medical
Human Research Ethics Committee

The University of Wollongong/Illawarra and Shoalhaven Local Health District Health and Medical HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research.

Appendix P PhD title update: 2016 Western Sydney University approval

RE: H9857 - Progress Report & Amendment Request Form

Kimberley Ann Pangilinan <K.Pangilinan@westernsydney.edu.au> on behalf of Human Ethics <HumanEthics@WesternSydney.edu.au>

Mon 8/22/2016 7:33 PM

To: Craig Slater <ces985@uowmail.edu.au>; Human Ethics <HumanEthics@WesternSydney.edu.au>;

Cc: anne.cusick@sydney.edu.au <anne.cusick@sydney.edu.au>;

Hi Craig,

Thank you for sending the approval through from UoW. Please accept this as formal acceptance and acknowledgement of the aforementioned amendments.

We will note the changed title in our system and the new expiry date. Please send through any further changes through to us. We will be in touch again in August 2017 for a Final Report.

All the best.

Kimberley Ann Pangilinan | Human Ethics Officer
Research Engagement, Development and Innovation (REDI)
Office of Deputy Vice Chancellor and Vice President, Research and Development
P: +61 2 4736 0278 | Ext: 2278
Email: k.pangilinan@westernsydney.edu.au

westernsydney.edu.au



RESEARCH WEEK
2016
October 24-28

Please be advised that it is not necessary to wait for an HREC submission deadline when submitting Low and Negligible Risk applications. The LNR meeting dates are online at: http://www.westernsydney.edu.au/research/research_ethics_and_integrity/human_ethics/apply_for_human_research_ethics_review

Appendix Q

Nurse Education Today

letter of acceptance

Your Submission NET-D-16-00559R2

Nurse Education Today <eesserver@eesmail.elsevier.com>

Wed 2/8/2017 8:38 AM

To: Craig Slater <ces985@uowmail.edu.au>;

Ms. Ref. No.: NET-D-16-00559R2

Title: Factors related to self-directed learning readiness of students in health professional programs: A scoping review
Nurse Education Today

Dear Craig,

We are pleased to confirm that your revised article "Factors related to self-directed learning readiness of students in health professional programs: A scoping review" has been accepted for publication in Nurse Education Today - congratulations.

Further instructions will be sent to you from Elsevier as soon as your article has moved into production.

Thank you for your contribution to the journal.

With kind regards,

Jill Tyldsley
Receiving Ed/Office
Nurse Education Today

On behalf of Editor Prof Amanda Kenny

Appendix R *BMC Medical Education* letter of acceptance

Decision on your Submission to BMC Medical Education - MEED-D-17-00159R2 - [EMID:98bea770d3aa2f11]

em.meed.0.56f679.5e59ede0@editorialmanager.com on behalf of
BMC Medical Education Editorial Office <em@editorialmanager.com>

Thu 11/2/2017 4:03 AM

To: Craig Slater <ces985@uowmail.edu.au>;

MEED-D-17-00159R2

Explaining variance in self-directed learning readiness of first year students in health professional programs
Craig E Slater, MPH; Anne Cusick, PhD; Jimmy C.Y. Louie, PhD
BMC Medical Education

Dear Mr Slater,

I am pleased to inform you that your manuscript "Explaining variance in self-directed learning readiness of first year students in health professional programs" (MEED-D-17-00159R2) has been accepted for publication in BMC Medical Education.

Before publication, our production team will also check the format of your manuscript to ensure that it conforms to the standards of the journal. They will be in touch shortly to request any necessary changes, or to confirm that none are needed.

Please do not hesitate to contact us if you have any questions regarding your manuscript and I hope that you will consider BMC Medical Education again in the future.

Best wishes,

Gerard Clunn
BMC Medical Education
<https://bmcmmededuc.biomedcentral.com/>

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Please also take a moment to check our website at <https://bmcmmededuc.biomedcentral.com/>

BMC Medical Education operates a policy of open peer review, which means that you will be able to see the names of the reviewers who provided the reports via the online peer review system. We encourage you to also view the reports there, via the action links on the left-hand side of the page, to see the names of the reviewers.

Appendix S Systematic review: PROSPERO registration

PROSPERO
International prospective register of systematic reviews



Psychometric properties of instruments measuring self-directed learning readiness: a systematic review

Craig Slater, Anne Cusick, Jimmy Louie

Citation

Craig Slater, Anne Cusick, Jimmy Louie. Psychometric properties of instruments measuring self-directed learning readiness: a systematic review. PROSPERO 2017 CRD42017078828 Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42017078828

Review question

Which instruments measuring self-directed learning readiness have been used with cohorts of students in pre-certification health professional programs?

What are the psychometric properties of the identified instruments measuring self-directed learning readiness?

Searches

A search will be conducted in the following electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), Educational Resources Information Center (ERIC), Scopus, Web of Science and PsycINFO (Psychological Abstracts). The search strategy will consist of search terms for the following three concepts: 1) health professions 2) pre-certification students 3) self-directed learning readiness. Included health professions will be: medicine, nursing, dentistry, and the twelve professions included in the Australian Health Workforce Advisory Committee (2006) definition of allied health (audiology, dietetics and nutrition, occupational therapy, orthotics and prosthetics, orthoptics, pharmacy, physiotherapy, podiatry, psychology, radiography, speech pathology and social work). There will be no restrictions in language or timeframe during the search. Searches with the names of each included instrument in combination with the search terms used for the study population will also be conducted until each instrument has been searched.

Types of study to be included

For inclusion in studies must:- be original research- be published in a peer-reviewed journal- be published in English- include participants in pre-certification programs in at least one of the listed health professions. Qualitative studies and literature reviews (other than systematic reviews) will be excluded.

Condition or domain being studied

In adult learning theories, the capacity for self-directed learning is understood to develop as individuals mature in their approaches to learning. Self-directed learners take initiative for their learning. They identify their learning needs, determine strategies to meet these needs, and then both implement and evaluate these strategies. In higher education, the development of self-directed learning attitudes and abilities have been desirable student learning outcomes for many institutions.

In health professional practice, readiness for self-directed learning has also been understood to be an important precursor to health professionals engaging in professional development activities to maintain knowledge and skill currency. Consequently, accreditation standards for most health professions require pre-certification health professional programs to develop students' attitudes and abilities in self-directed, lifelong learning. Educators and researchers in the health professions have, therefore, sought to measure students' self-directed learning readiness, particularly at different stages of the program, to determine changes over time and evaluate strategies aimed at enhancing student attitudes and abilities. Several instruments have been used in the literature, however, there is a need to compare and evaluate the psychometric properties of instruments to ascertain which provide a rigorous and relevant measure of self-directed learning readiness in pre-certification health cohorts of students in medicine, nursing, dentistry and allied health professions.

PROSPERO

International prospective register of systematic reviews



Participants/population

The focus of this review will be on students in pre-certification programs in the health professions identified above. Post-certification students and qualified professionals will not be included in the review.

Intervention(s), exposure(s)

Not applicable - participants in included studies will have completed a quantitative instrument which aims to measure self-directed learning readiness. Studies may answer impact or non-impact questions.

Comparator(s)/control

None

Primary outcome(s)

Psychometric properties of instruments measuring self-directed learning readiness.

Secondary outcome(s)

None

Data extraction (selection and coding)

All papers retrieved through the database search will be reviewed by two independent reviewers. Reviewers will first screen the title and abstract of all papers against the listed eligibility criteria. The reviewers will then read the full text of papers not eliminated in the initial screen and determine studies for inclusion against the eligibility criteria. Any disagreement between reviewers will be resolved by reviewers re-reading the paper and discussing until consensus reached or referring the paper to a third reviewer to make the final decision. Data from included studies will be extracted using a data extraction form developed by the researchers. Data extracted from studies will include: citation details (author, title, journal, year), location/s of the study, discipline/s involved, study design, instrument/s used, sample size, brief summary of findings, and psychometric properties presented.

Risk of bias (quality) assessment

Included studies will be assessed for methodological quality using the Consensus-Bases Standards for the Selection of Health Status Measurement Instruments (COSMIN) checklist with 4-point scale (excellent, good, fair, poor) (Terwee et al 2011). The checklist will be applied to studies which present psychometric data to evaluate the following psychometric properties: internal consistency, reliability, measurements error, content validity, structural validity, hypothesis testing, cross-cultural validity, criterion validity, responsiveness, interpretability and generalizability.

Strategy for data synthesis

Findings will be described narratively and tabled, if appropriate.

Analysis of subgroups or subsets

None

Contact details for further information

Craig Slater
ces985@uowmail.edu.au

Organisational affiliation of the review

None

Review team members and their organisational affiliations

Mr Craig Slater. University of Wollongong
Professor Anne Cusick. University of Sydney
Dr Jimmy Louie. University of Hong Kong

Anticipated or actual start date

PROSPERO
International prospective register of systematic reviews



01 August 2017

Anticipated completion date

31 January 2018

Funding sources/sponsors

Australian Government Research Training Program Scholarship

Conflicts of interest

None known

Language

English

Country

Australia, Hong Kong, United States of America

Stage of review

Ongoing

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

Humans; Learning; Psychometrics; Surveys and Questionnaires

Date of registration in PROSPERO

23 November 2017

Date of publication of this version

06 October 2017

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	No
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Versions

06 October 2017

PROSPERO

This information has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. CRD bears no responsibility or liability for the content of this registration record, any associated files or external websites.

Appendix T Confirmation of systematic review protocol submission to the journal *Systematic Reviews*

Confirmation of your submission to Systematic Reviews SYSR-D-17-00401

em.sysr.0.580cd6.8ab30a2d@editorialmanager.com on behalf of
Systematic Reviews Editorial Office <em@editorialmanager.com>

Thu 12/21/2017 3:43 PM

To: Craig Slater <ces985@uowmail.edu.au>;

SYSR-D-17-00401

Psychometric properties of instruments measuring self-directed learning readiness: A systematic review protocol

Craig E Slater, MPH, BOccThy; Anne Cusick, PhD
Systematic Reviews

Dear Mr Slater,

Thank you for submitting your manuscript 'Psychometric properties of instruments measuring self-directed learning readiness: A systematic review protocol' to Systematic Reviews.

The submission id is: SYSR-D-17-00401

Please refer to this number in any future correspondence.

During the review process, you can keep track of the status of your manuscript by accessing the following website:

<http://sysr.edmgr.com/>

If you have forgotten your username or password please use the "Send Login Details" link to get your login information. For security reasons, your password will be reset.

Best wishes,

Editorial Office

Systematic Reviews

<https://systematicreviewsjournal.biomedcentral.com/>

-----END OF THESIS-----